

Peripheral Vascular Disease

Kenneth Madsen MD

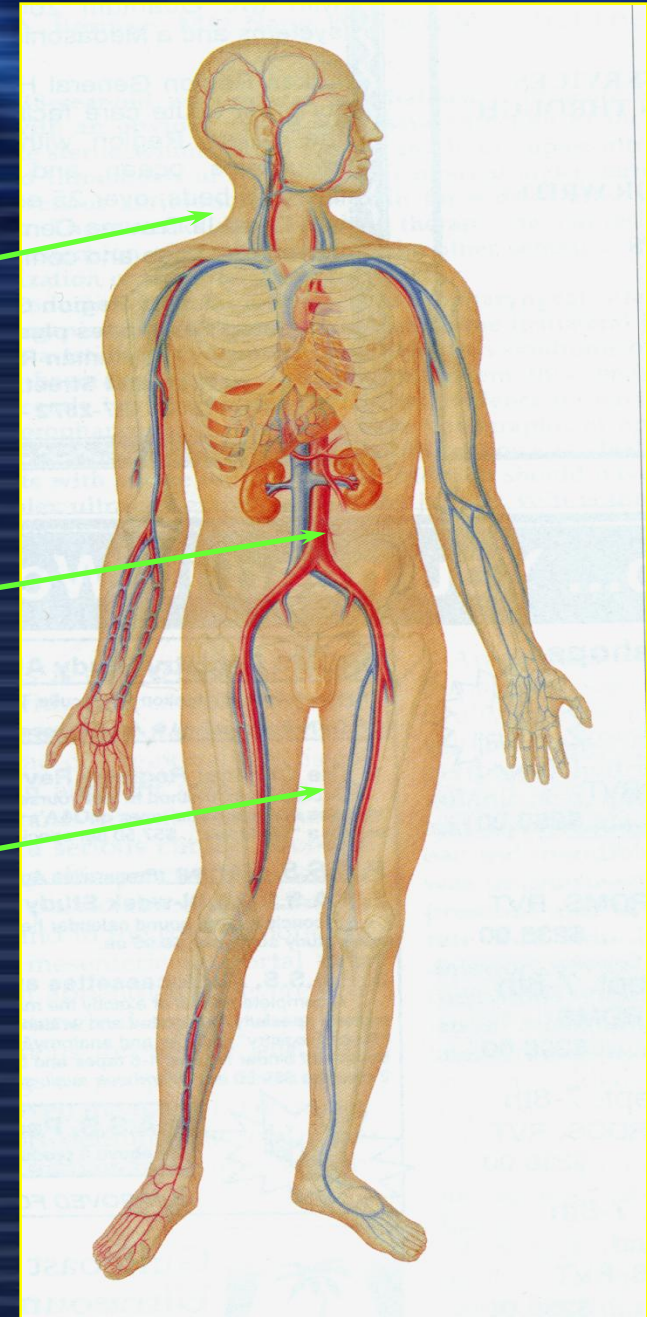
Wyoming Department of Health
Telehealth Training

February 12, 2010



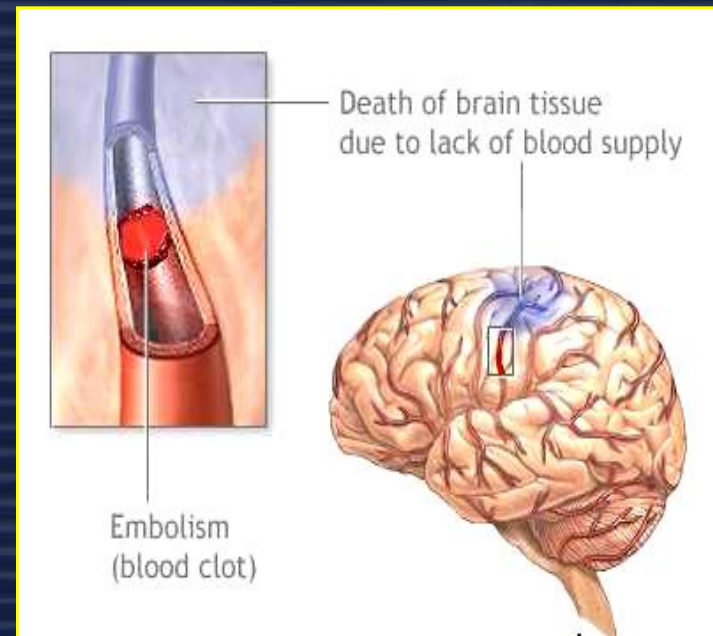
Vascular Surgery

- Carotid Disease
- Abdominal Aortic Aneurysms
- Peripheral Arterial Disease
- Venous Disease



Magnitude of the Problem

- Stroke: 3rd leading cause of death in U.S.
- Affects 600,000 patients/year
 - 1/3 die
 - 1/3 survive with marked deficits
- Cost of treatment ~ \$30 billion/year
- Carotid bifurcation disease
 - 40% of strokes

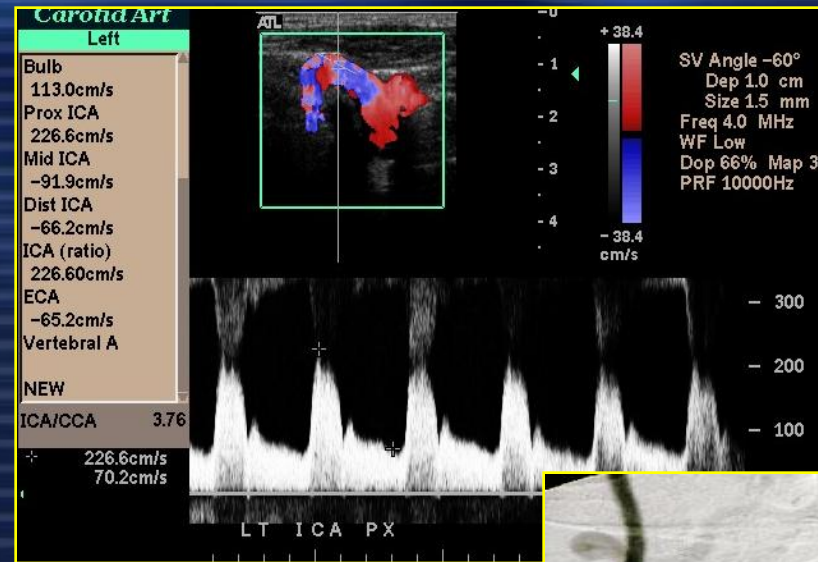


Clinical Presentation

- Carotid Bruit
- TIA (Transient Ischemic Attack) <24 hrs
 - Contralateral motor and sensory symptoms
 - Motor: dysarthria, weakness, paralysis, or clumsiness
 - Sensory: numbness, loss of sensation
- Amaurosis Fugax
 - Ipsilateral transient monocular visual disturbance
- Stroke

Diagnosis

Duplex Ultrasound



Cerebral Angiography

CT Angiogram

MRA

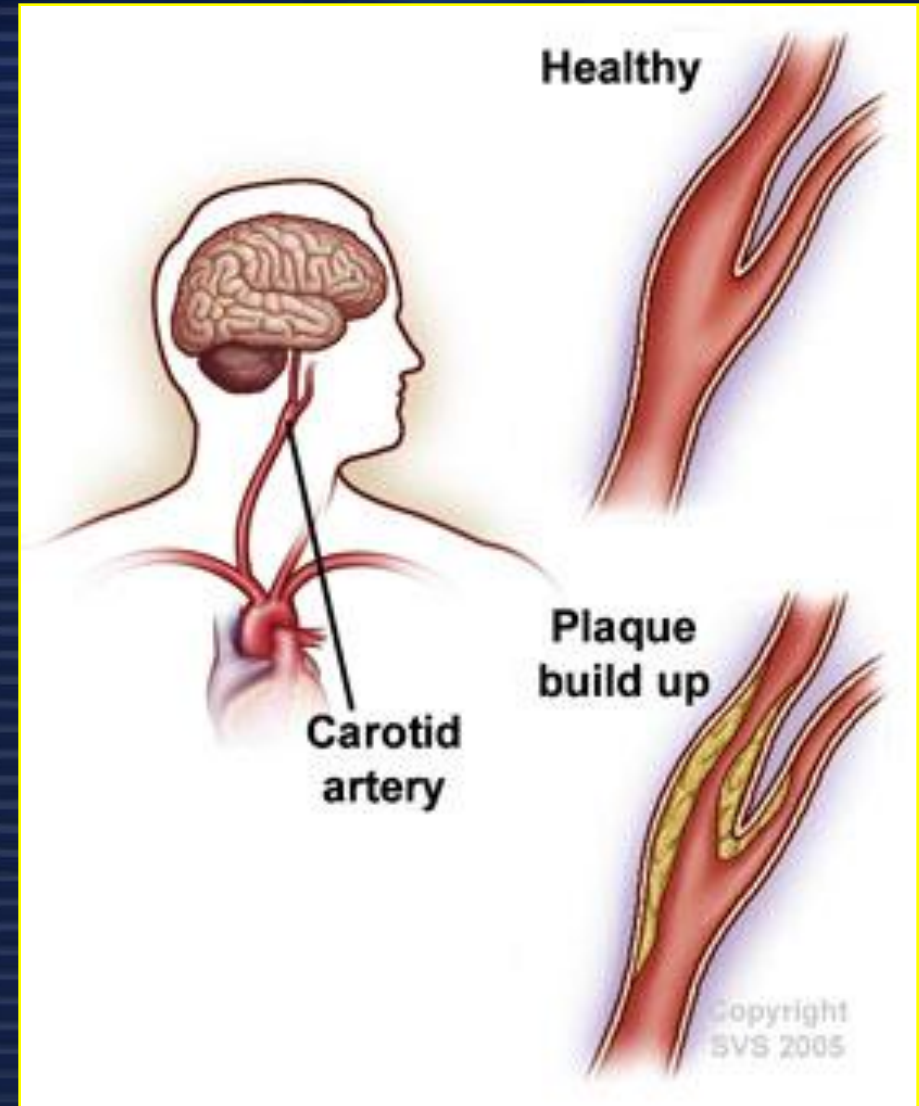


Referral to Vascular Surgeon

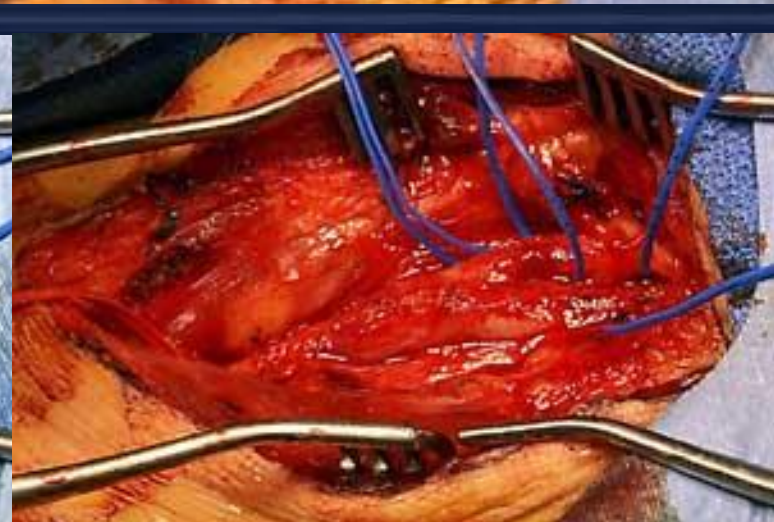
- Symptomatic patients †
 - >50% stenosis
- Asymptomatic patients *
 - >70% stenosis

†NASCET NEJM 1991;325:445-53

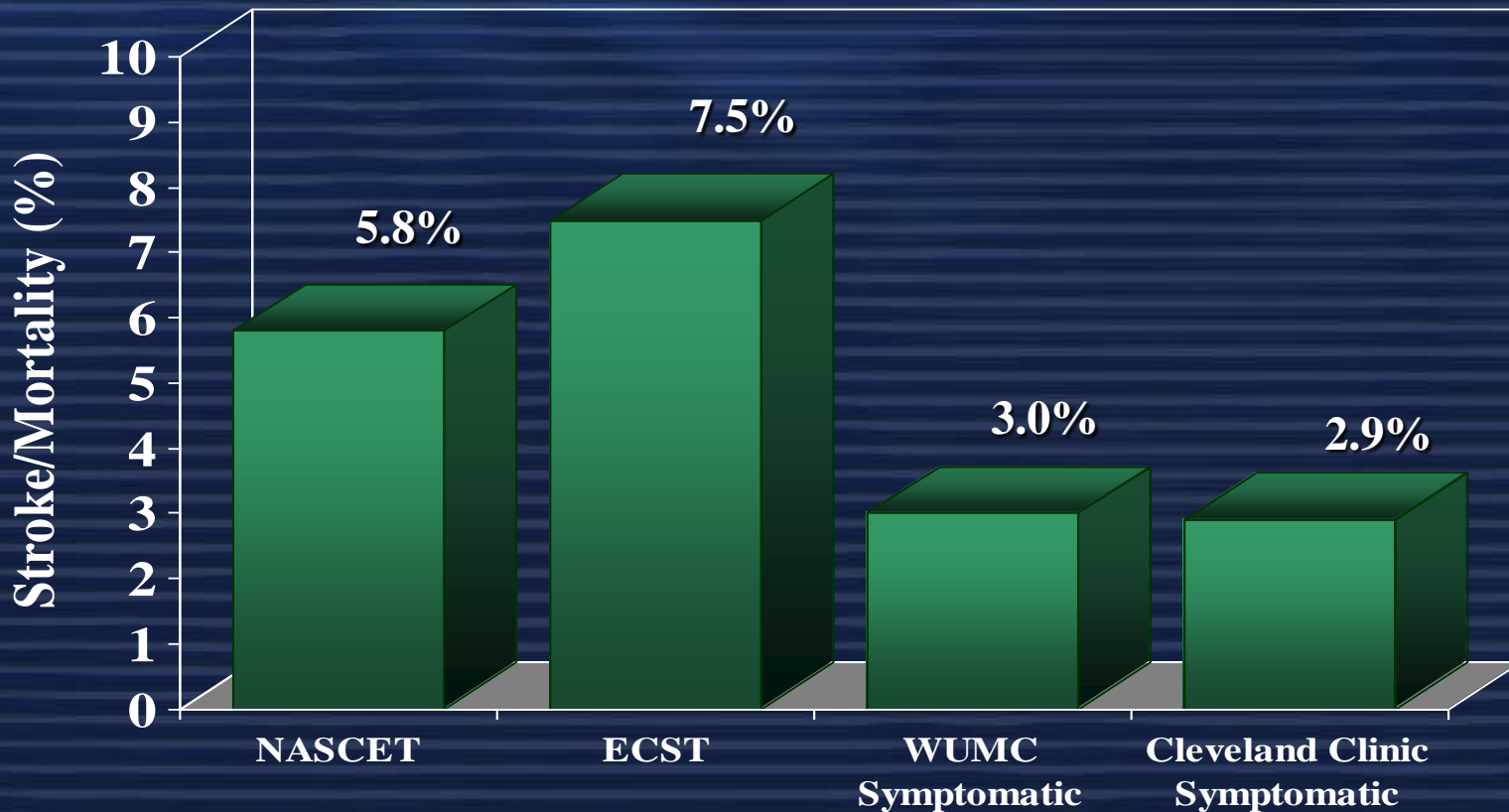
*ACST Lancet 2004; 363:1491-502



CAROTID ENDARTERECTOMY



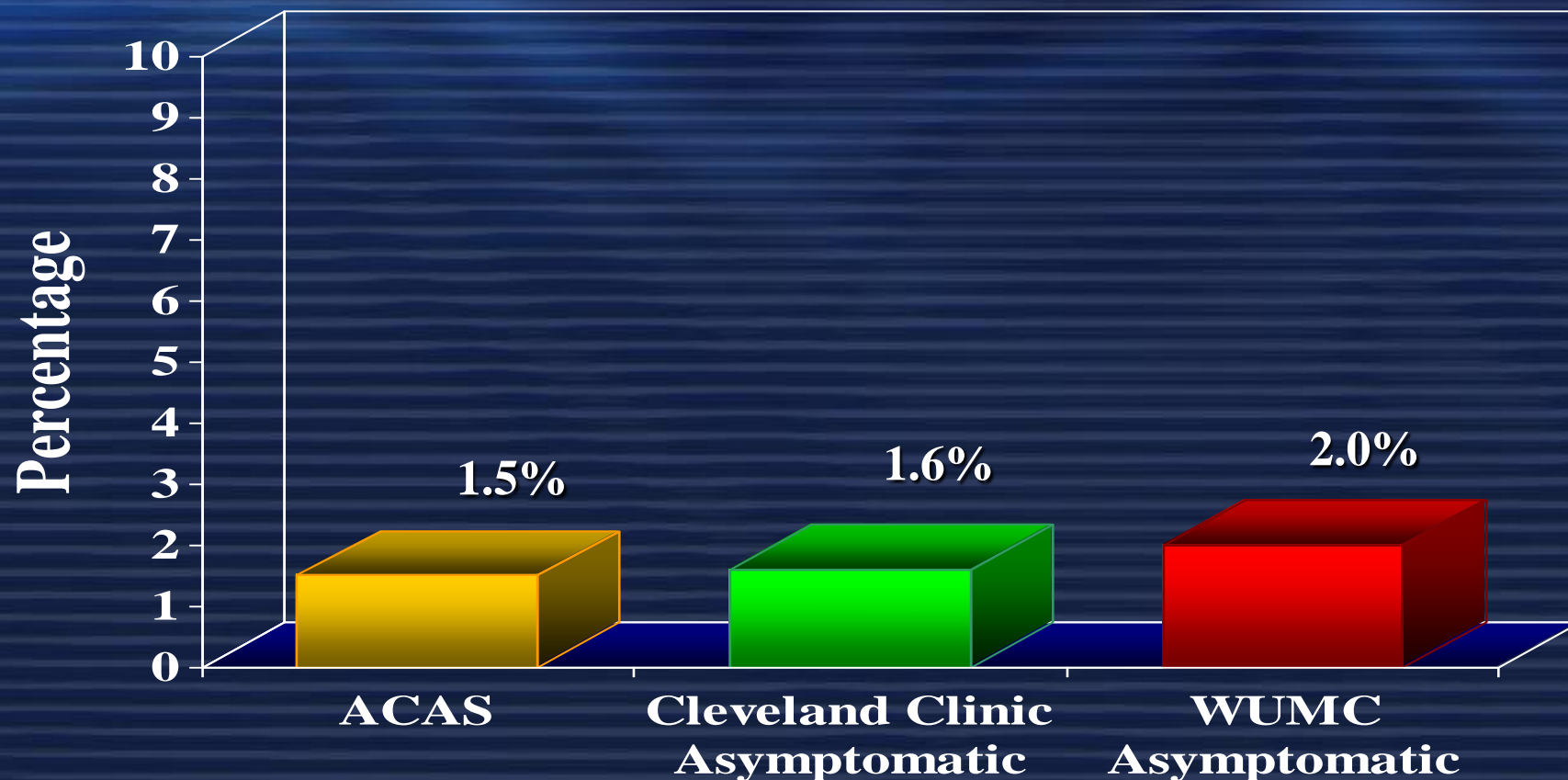
CAROTID ARTERY BIFURCATION DISEASE: RESULTS OF ENDARTERECTOMY (*SYMPTOMATIC INDICATIONS*)



- *NASCET-N Eng J Med 1991; 325:445-53.*
- *ECST-Lancet 1991; 337:1235-43.*

- *WUMC-J Vasc Surg 1994; 19:834-43.*
- *Cleveland Clinic-J Vasc Surg 1997; 26:1-10.*

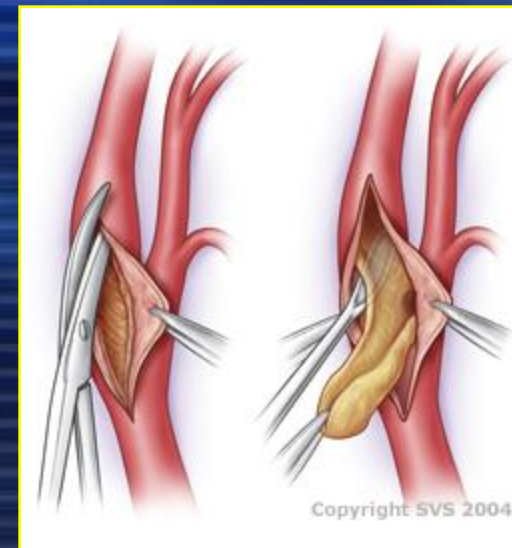
CAROTID ARTERY BIFURCATION DISEASE: RESULTS OF ENDARTERECTOMY (ASYMPTOMATIC INDICATIONS)



- ACAS-JAMA 1995; 273:1421-1428.
- Cleveland Clinic-J Vasc Surg 1997; 26:1-10.
- WUMC-J Vasc Surg 1994; 19:834-43.

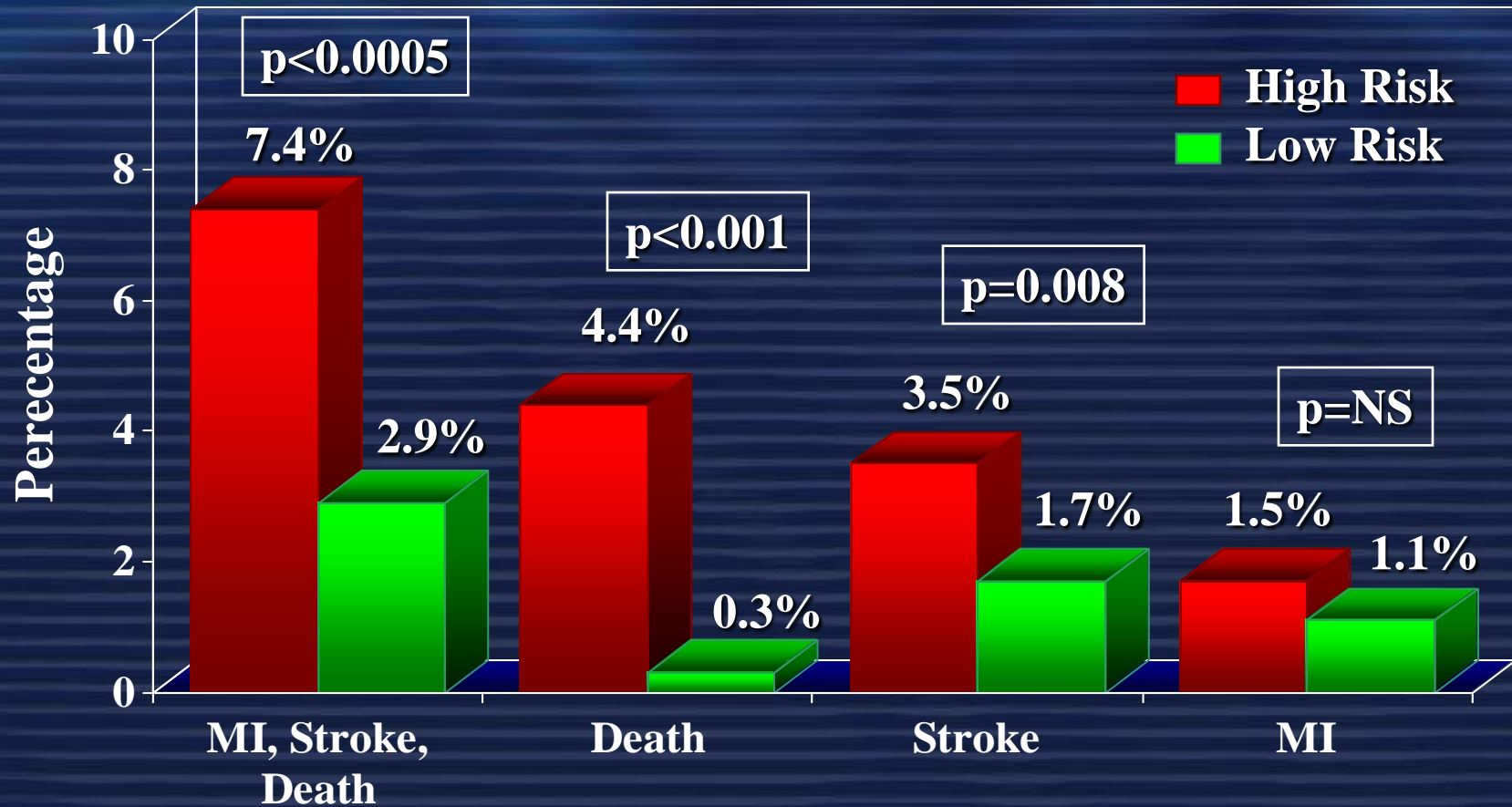
RISK STRATIFICATION IN CAROTID ENDARTERECTOMY*

- Cleveland Clinic Experience 1988-1998
 - 3,061 CEA's
 - 2,467 Low risk (80.6%)
 - 594 High risk (19.4%)
- High Risk Criteria
 - Coronary artery disease requiring PTA or CABG within 6 months preceding CEA
 - History of congestive heart failure
 - Severe COPD
 - Renal insufficiency (S Cr \geq 3mg/dl)



* *Ouriel K, et al. J Vasc Surg 2001; 33:728-732.*

RISK STRATIFICATION IN CAROTID ENDARTERECTOMY*



* Ouriel K, et al. J Vasc Surg 2001; 33:728-732.

LESS INVASIVE ALTERNATIVE: CAROTID ANGIOPLASTY AND STENTING (CAS)



+



= ?

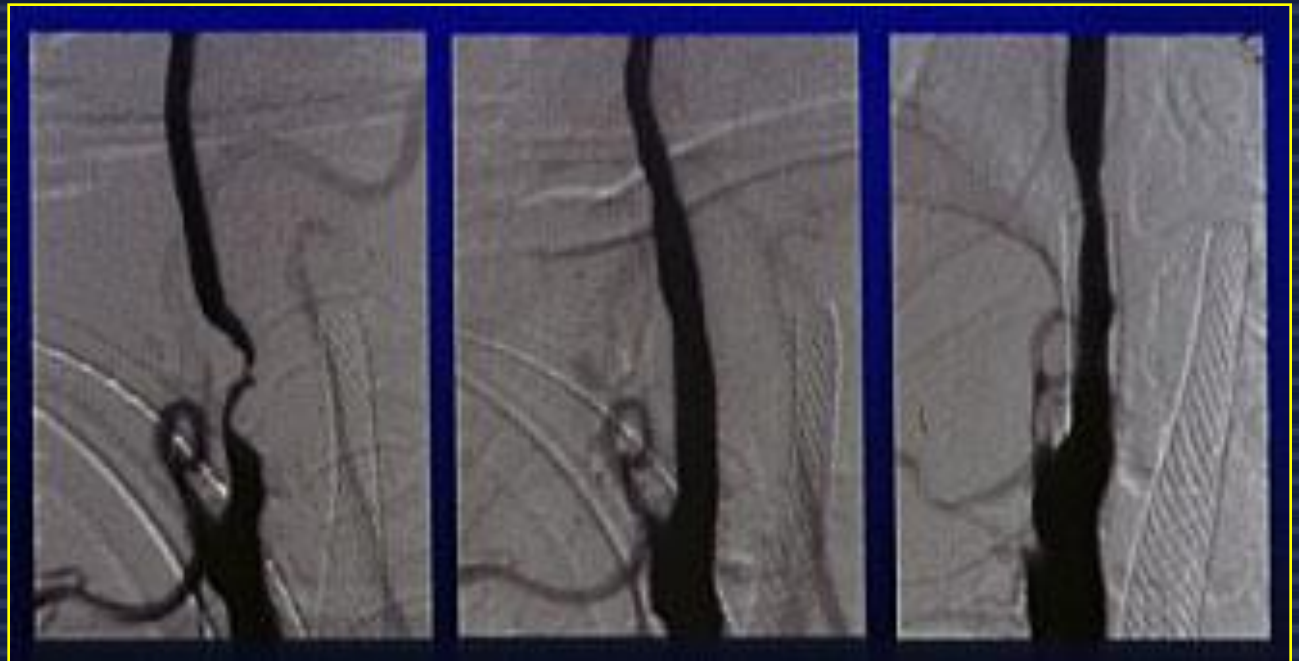
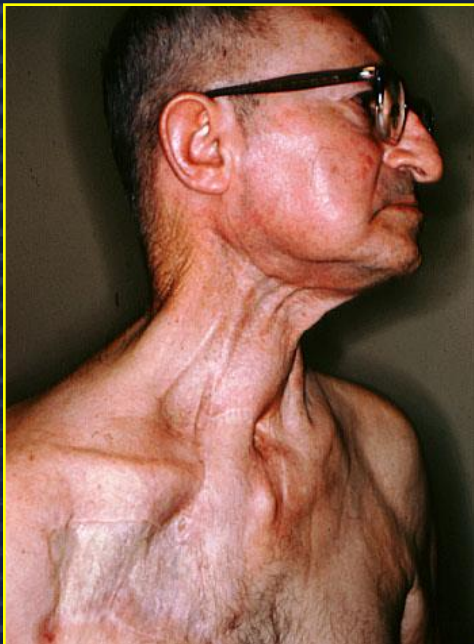
EARLY INDICATIONS FOR CAS

- Surgically inaccessible lesion
- Recurrent carotid stenosis
- Hostile neck (XRT or previous neck dissection)
- High risk medical comorbidities
- Unstable cervical spine

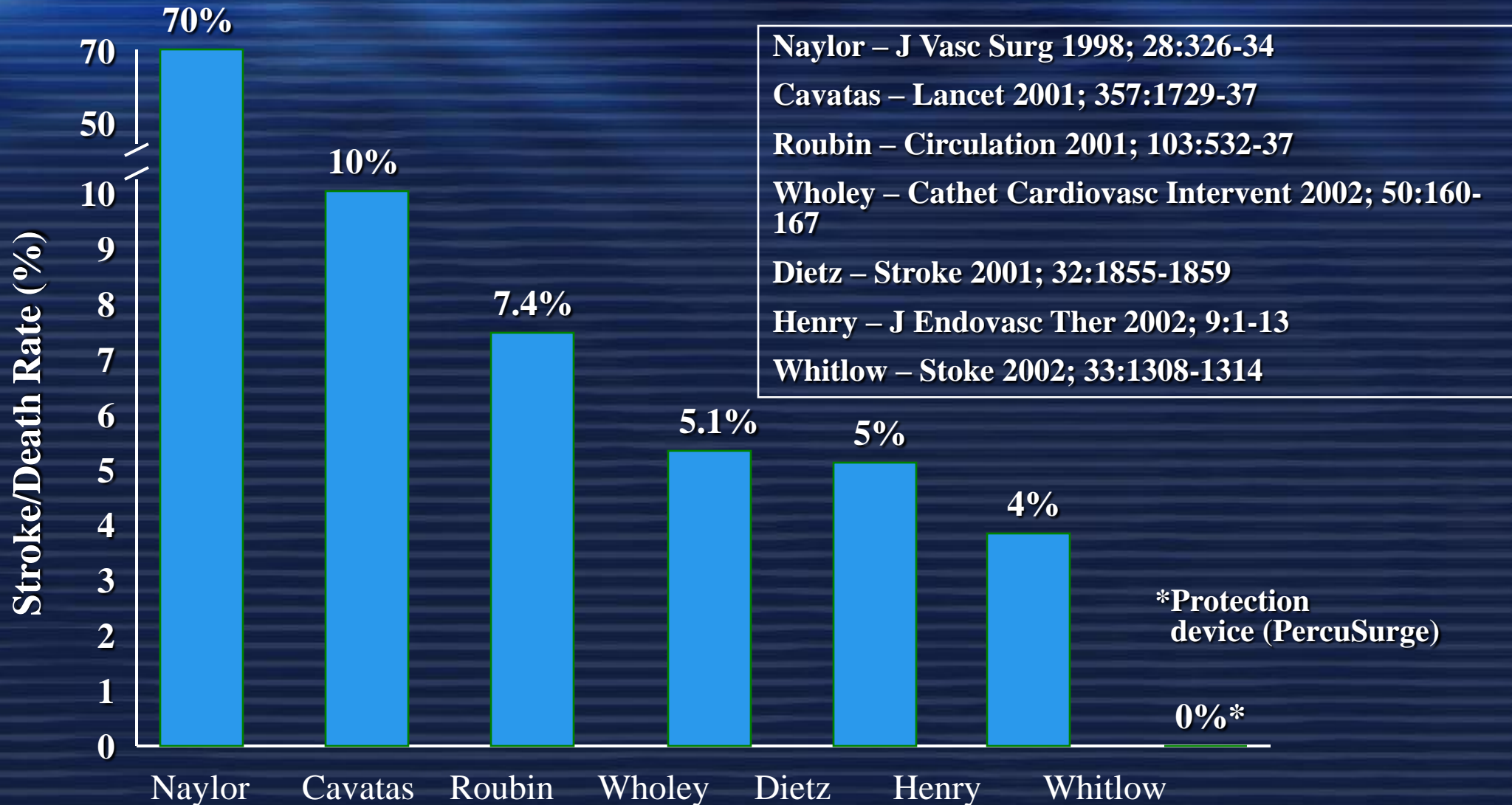


CAROTID STENOSIS IN HOSTILE NECK

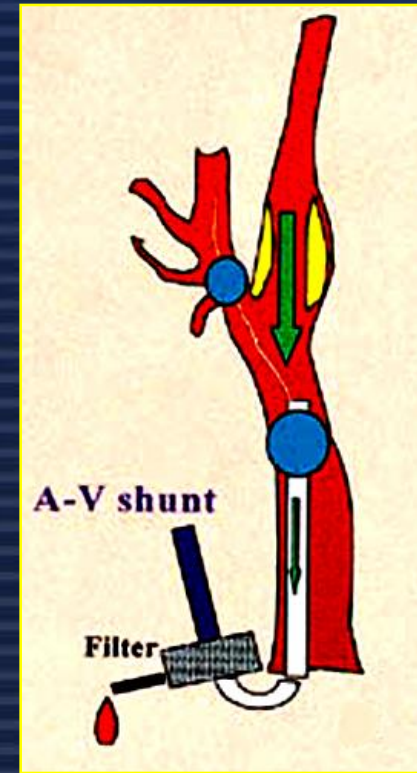
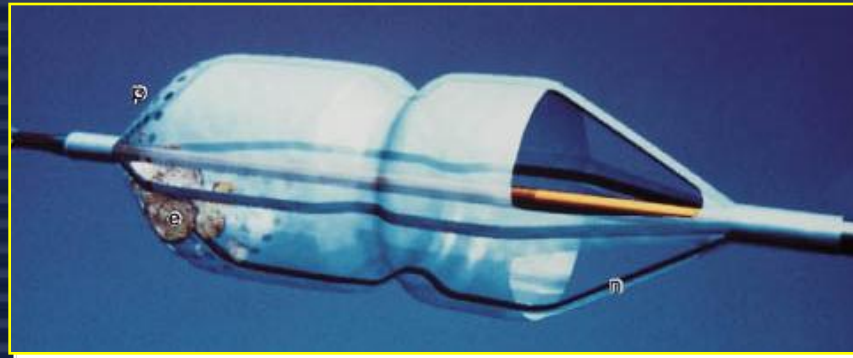
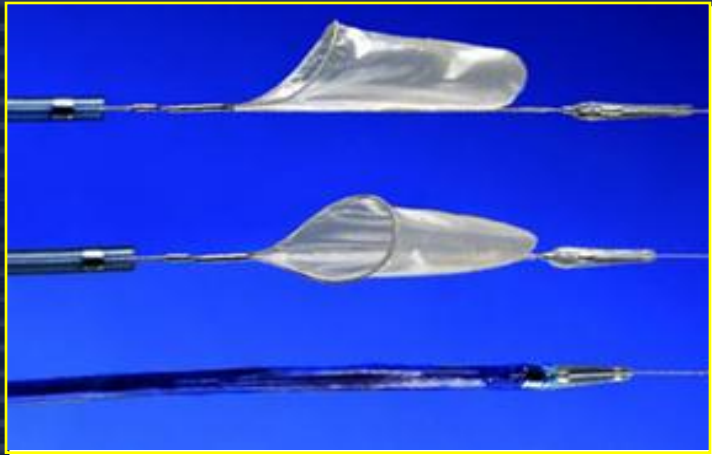
- 66-Year-old male with a history of :
 - Radical neck dissection and radiation for laryngeal CA
 - Bilateral carotid stents



RESULTS OF CAROTID ARTERY ANGIOPLASTY- STENTING: ***SELECTED EARLY SERIES***

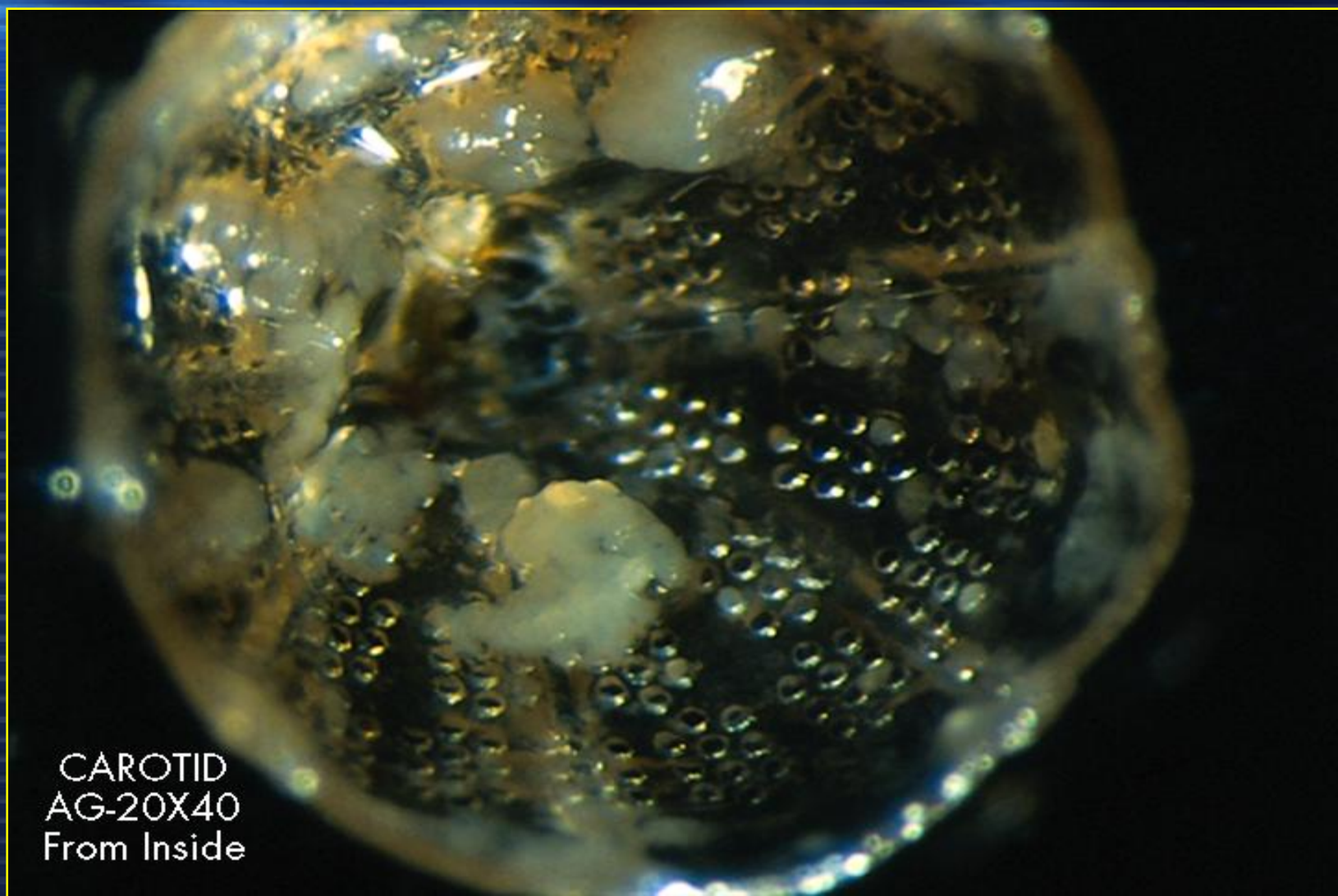


Cerebral Protection Devices



Unprotected vs. Protected CAS

	N	Stroke/Death Rate	
		Un-Protected	Protected
Henry M	315	4.9%	2.2%
Roubin GS	1276	6.9%	1.8%
Mathias K	406	3.0%	1.3%
German registry	636	2.8%	2.0%
Global registry	10693	5.3%	2.3%



CAROTID
AG-20X40
From Inside

CONCLUSIONS

- CAS is an FDA approved alternative to CEA in high risk patients.
- Cerebral embolization during CAS is universal.
- Cerebral protection during CAS is mandatory.
- The technology is rapidly evolving with potentially wider applications.

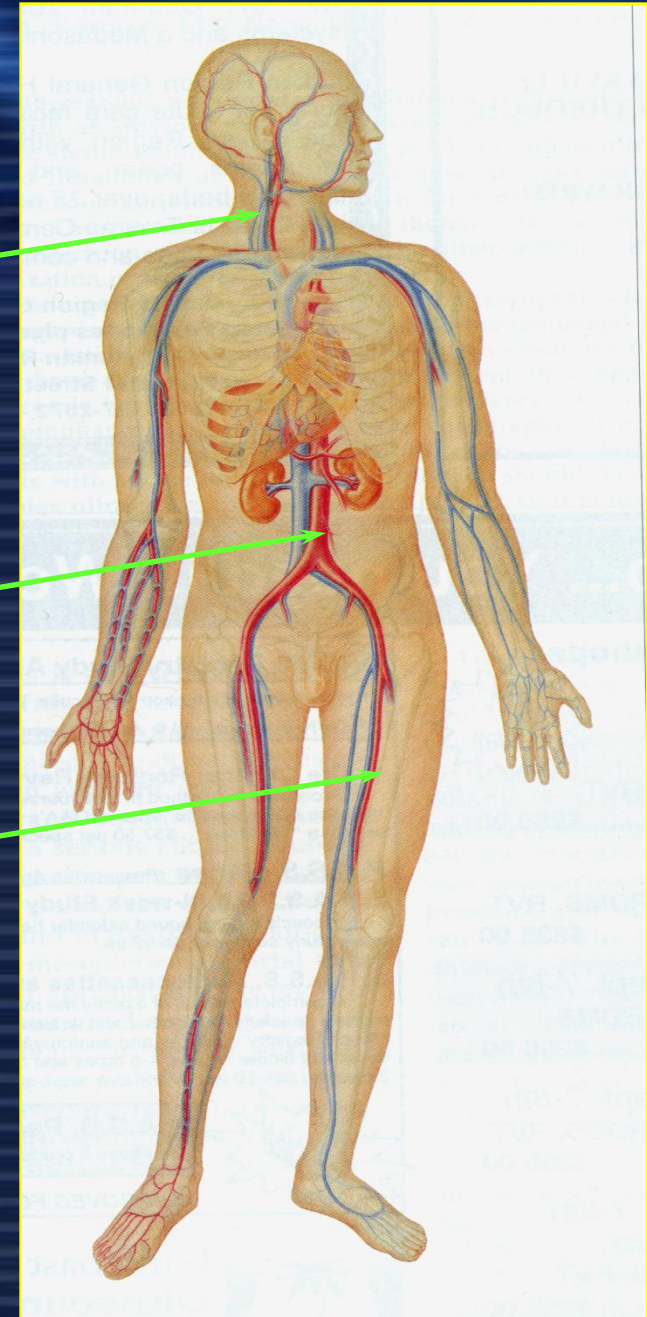
CMS Draft Decision 12/17/2004

- Proposal to expand coverage for CAS for pts at high risk for surgery
 - Symptomatic >70% stenosis
 - Poor candidate for *vascular surgery*
 - Limited to factors making surgery necessary for

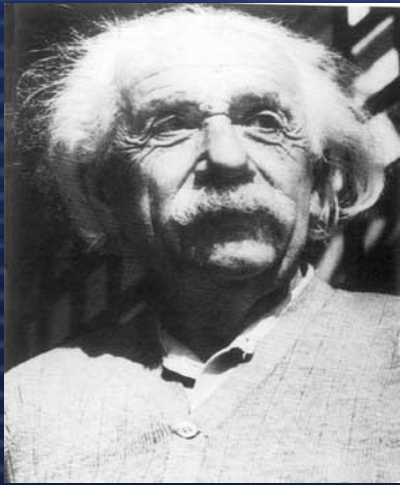
- congestive heart failure (CHF) class III/IV
- left ventricular ejection fraction (LVEF) < 30%
- unstable angina
- contralateral carotid occlusion
- recent myocardial infarction (MI)
- previous CEA with recurrent stenosis
- prior radiation treatment to the neck

Vascular Surgery

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Notable Persons With Ruptured AAA



Albert
Einstein



Lucille Ball



Conway
Twitty



Roy
Rogers

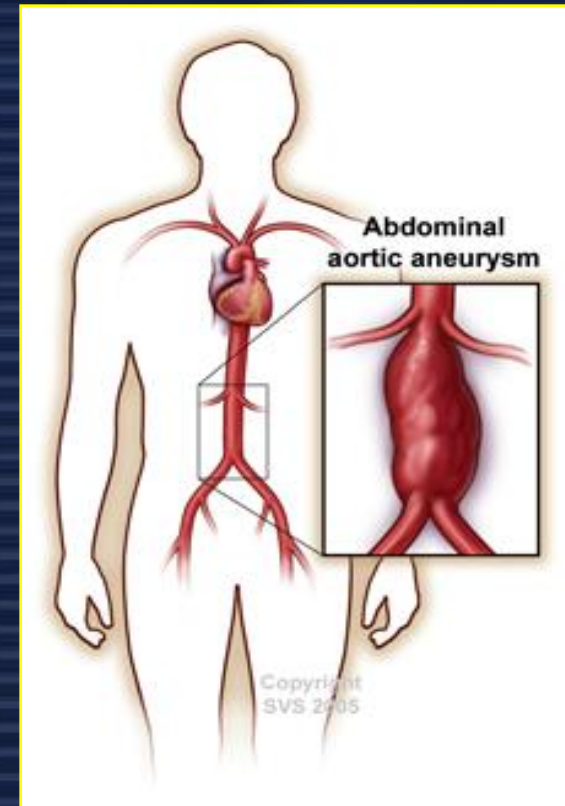


George C.
Scott

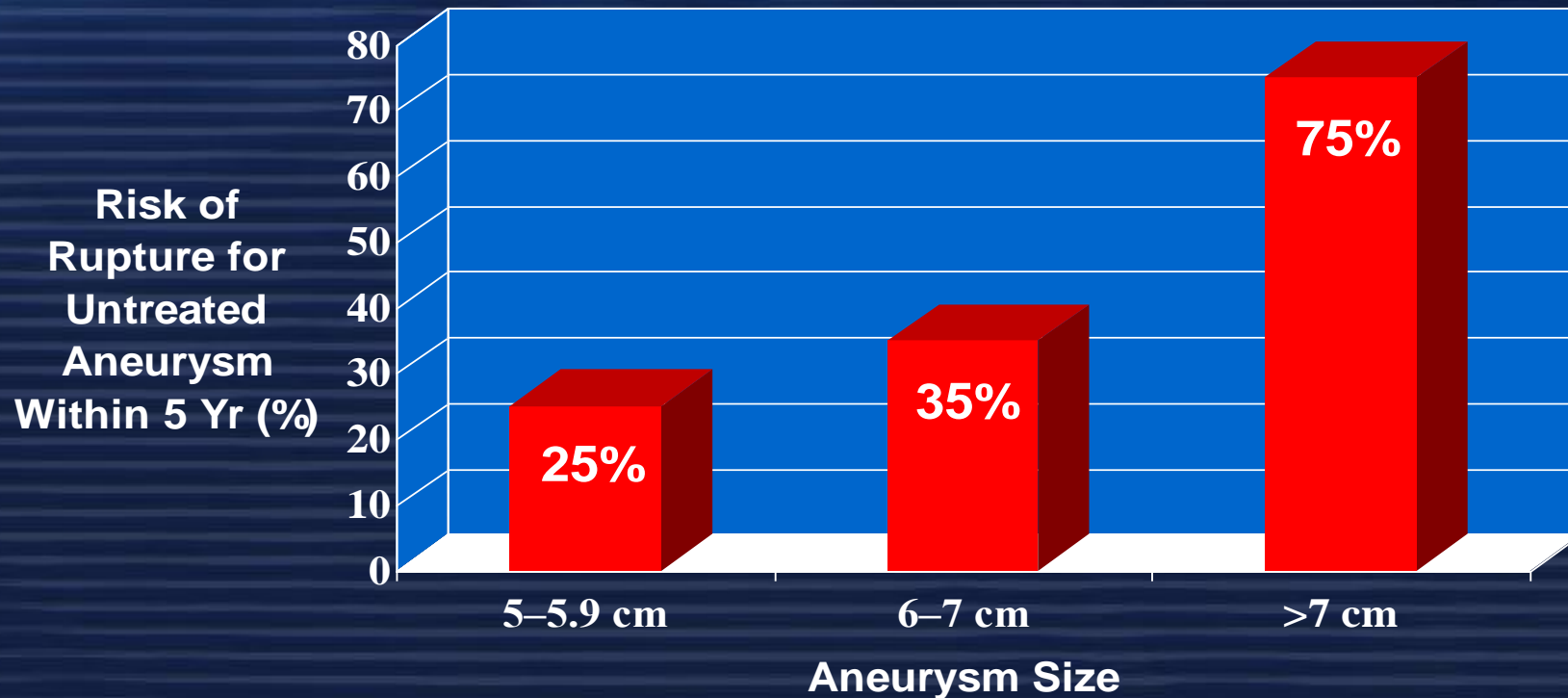
only Roy Rogers survived ruptured AAA

Magnitude of the Problem

- >15,000 deaths/year: 17th leading cause of death in the US
- Estimated 1,670,000 ⁽²⁾ with AAA in U.S.
 - 200,000 ⁽³⁾ are diagnosed each year
- 50% of emergent cases arrive in ER alive
 - 50% surgical intervention



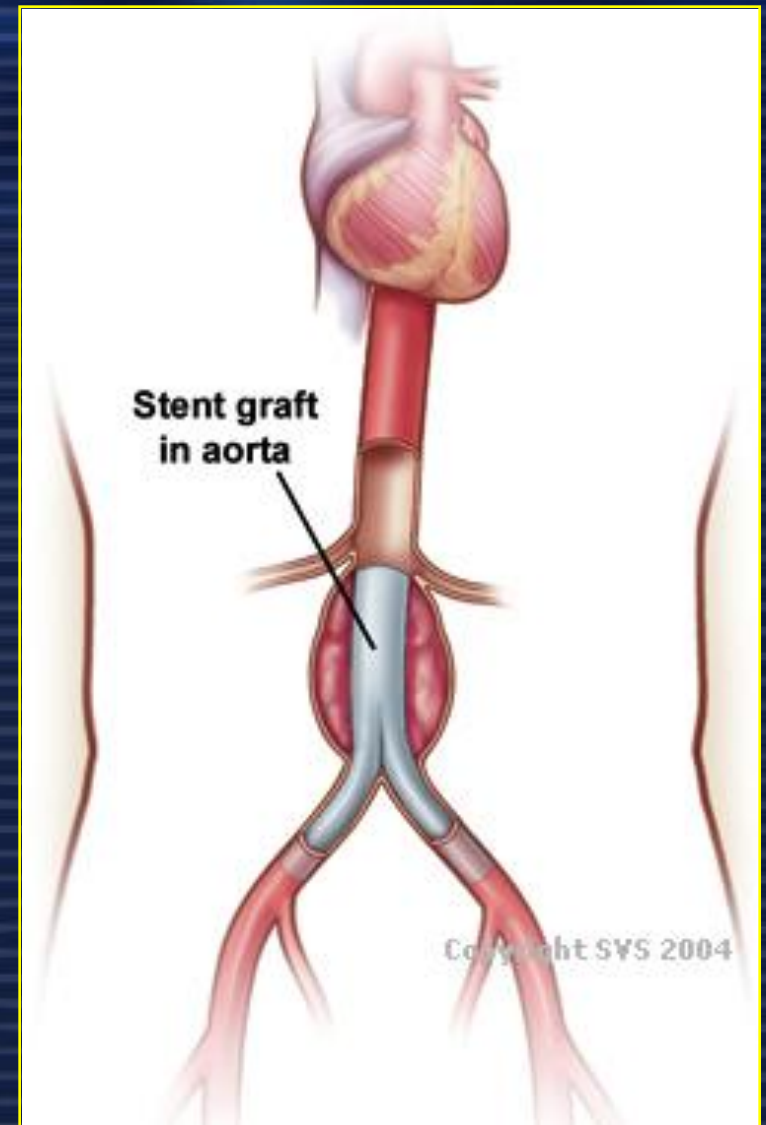
Watch and Wait: Risk of Rupture



Mitchell, MD, Rutherford RB, Krupski WC. "Infrarenal Aortic Aneurysm" in *Vascular Surgery* (4th Ed. Vol. II) WB Saunders Co., Philadelphia, PA 1995.

Update Topics

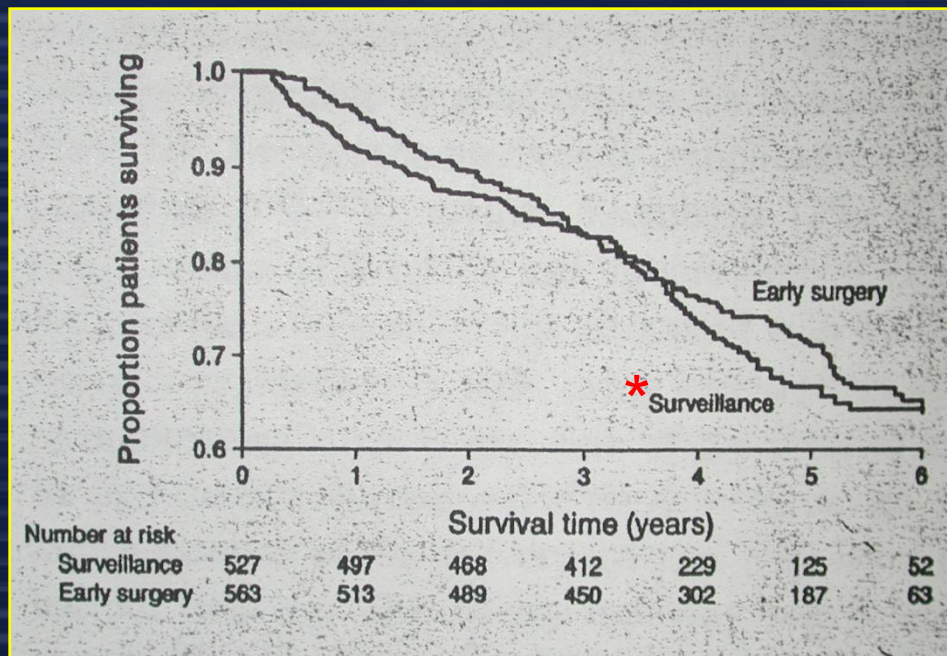
- Patient Selection
- EVAR vs Open Repair
- EVAR Basic Technique
- EVAR Patient selection
- Device Failure Analysis
- Today's EVAR Devices



Management of Small AAAs

UK Small Aneurysm Trial

- 1090 pts with small AAAs (4.0-5.5 cm) randomized to surgery vs. surveillance
- U/S Q6 months until 5 cm, then Q3 months



**No survival
advantage for
early surgery**

* 61% of surveillance pts had AAA repair over 5 years

Outcomes After Open Aneurysm Repair

Open infrarenal abdominal aortic aneurysm repair: The Cleveland Clinic experience from 1989 to 1998

Norman R. Hertzer, MD,^a Edward J. Mascha, MS,^b Mathew T. Karafa, MS,^b Patrick J. O'Hara, MD,^a Leonard P. Krajewski, MD,^a and Edwin G. Beven, MD,^a *Cleveland, Ohio*

Purpose: The purpose of this study was to determine the safety and durability of traditional surgical treatment for asymptomatic infrarenal abdominal aortic aneurysms (AAAs) in a large series of patients who underwent open operations during the decade preceding the current study.

Methods: From 1989 to 1998, 1145 patients (mean age 70 ± 7 years) underwent elective graft replacement of infrarenal AAAs. The study was complemented with a retrospective review of hospital charts and a telephone survey to determine survival rates and the

The 30-day mortality rate was 1.2%.

Of the 1047 patients who survived their operations and remained available for follow-up study, only four (0.4%) have had late complications that were related to their aortic replacement grafts.

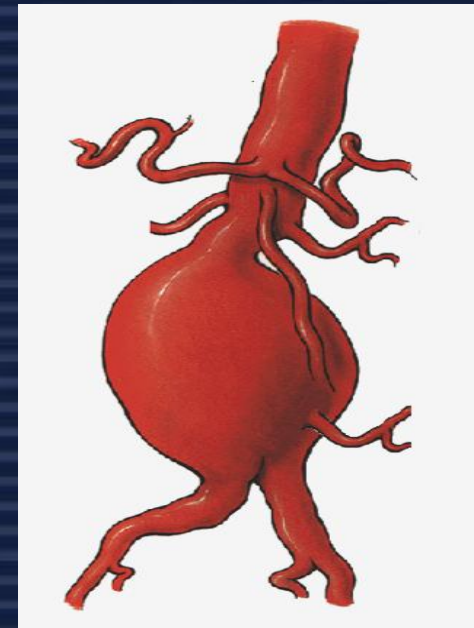
long-term mortality rate primarily in patients with a mean age of more than 75 years (risk ratio [RR], 2.2; 95% CI, 1.7 to 2.8) or previous history of congestive heart failure (RR, 2.1; 95% CI, 1.3 to 3.4), chronic pulmonary disease (RR, 1.5; 95% CI, 1.2 to 2.0), or renal insufficiency (RR, 3.2; 95% CI, 2.2 to 4.6). Of the 1047 patients who survived their operations and remained available for follow-up study, only four (0.4%) have had late complications that were related to their aortic replacement grafts.

Conclusion: These results reconfirm the exemplary success of open infrarenal AAA repair. The future of endovascular AAA repair is exceedingly bright, but until the long-term outcome of the current generation of stent grafts is adequately documented, their use should be justified by the presence of serious surgical risk factors. (J Vasc Surg 2002;35:1145-54.)

Endovascular vs. Open Repair

- EVAR 1 Trial (UK)
- Randomized Controlled Trial
- 1999 to 2003
- 1082 pts (>60yo, >5.5 cm) fit for open repair
- EVAR (n=531), Open Repair (n=516)
- All cause 30 day mortality

Lancet 2004; 364: 843-848

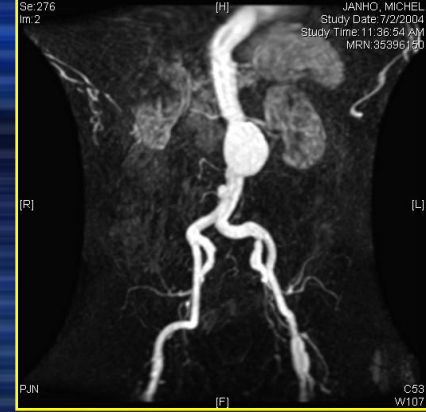


30 Day Mortality

	EVAR	Open repair	Odds ratio (95% CI)		p	
			Crude	p	Adjusted*	p
Outcome by intention to treat (number of patients)	531	516				
30-day mortality (number of deaths)	1.7% (9)	4.7% (24)	0.35 (0.16–0.77)	0.009	0.37 (0.17–0.83)	0.016
In-hospital mortality (number of deaths)	2.1% (11)	6.2% (32)	0.32 (0.16–0.64)	0.001	0.30 (0.14–0.62)	0.001
Median (IQR) length of hospital stay (days) [†]	7 (5–10)	12 (9–16)				<0.0001 [‡]
Median (IQR) length of operation (min) [†]	180 (140–215)	200 (155–240)				<0.0001 [‡]
Secondary interventions either during 30 days or during the primary admission						
Conversion to open repair	10	0				
Correction of endoleak	18	1				
Re-exploration of open repair	1	15				
Other surgery	21	14				
Unknown	2	0				
Total	52 (9.8%)	30 (5.8%)				0.02 [§]
Outcome by per protocol (number of patients)	512	496				
30-day mortality (number of deaths)	1.6% (8)	4.6% (23)	0.33 (0.15–0.74)	0.007	0.34 (0.15–0.78)	0.011
In-hospital mortality (number of deaths)	1.6% (8)	6.0% (30)	0.33 (0.15–0.74)	0.007	0.34 (0.15–0.78)	0.011

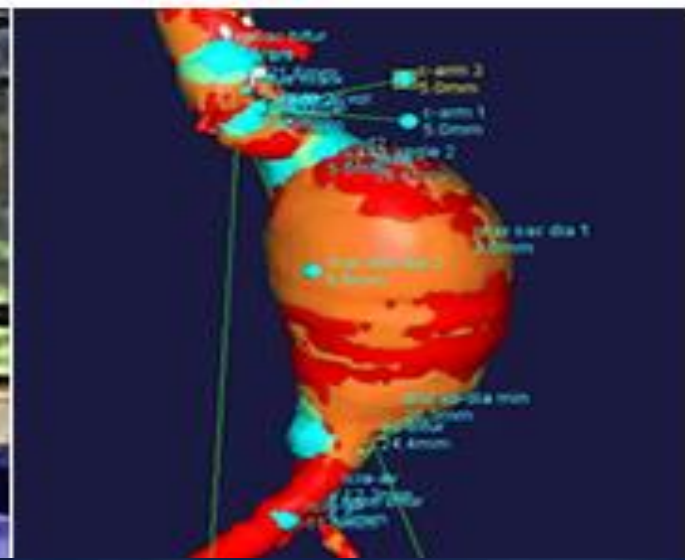
30 Day Mortality:
EVAR 1.6% vs Open Repair 4.6%

DREAM Trial



- Dutch Randomized Endovascular Management Trial Group
- Between 2000-2003
- 345 pts, AAA>5 cm
- Suitable candidates for open repair
- All cause 30 day mortality
 - Open Repair (n=174) 4.6%
 - Endovascular Repair (n=171) 1.2%

NEJM 2004; 351: 1607-1618



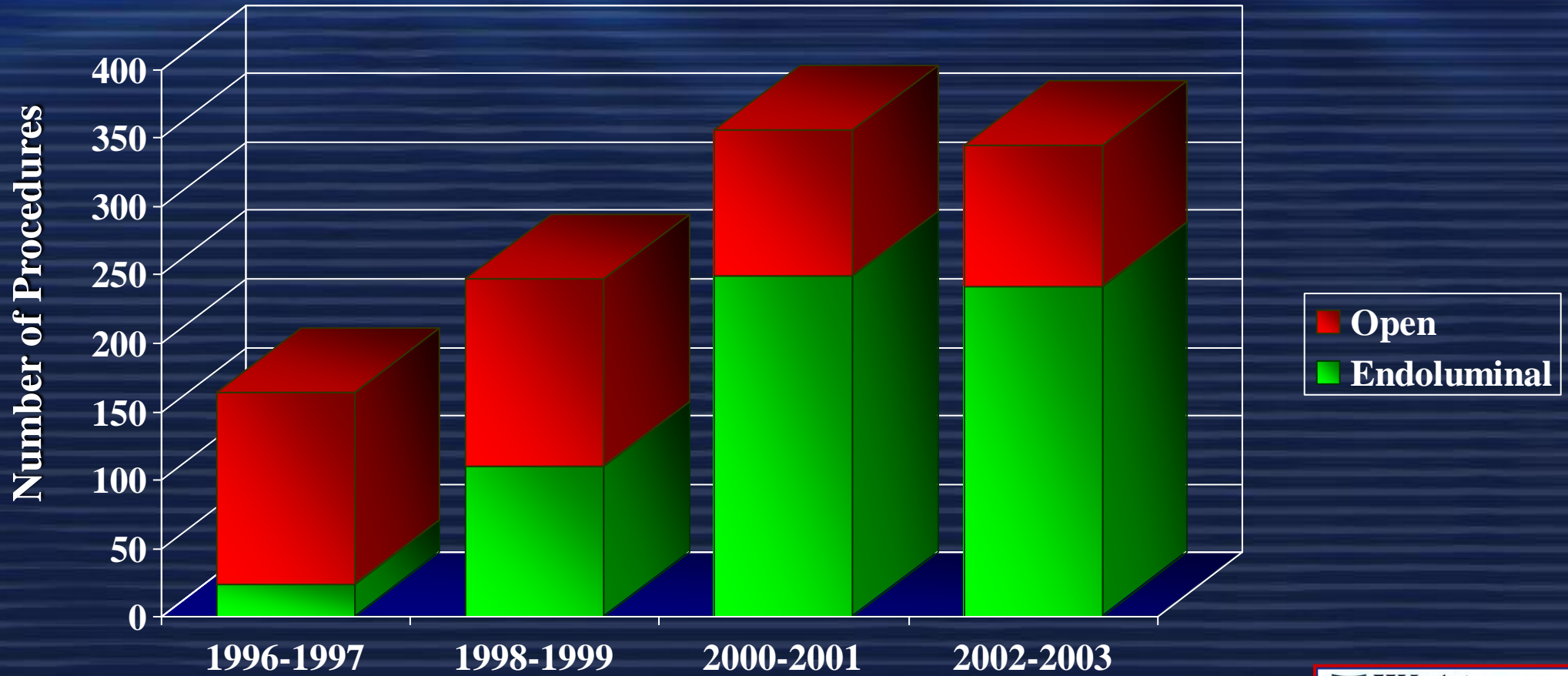
Current Practice

- All patients are considered for EVAR.
- EVAR is associated with lower morbidity and mortality.
- We recognize that long-term outcomes (>10 years) after EVAR are unknown.
- Life long surveillance after EVAR required.

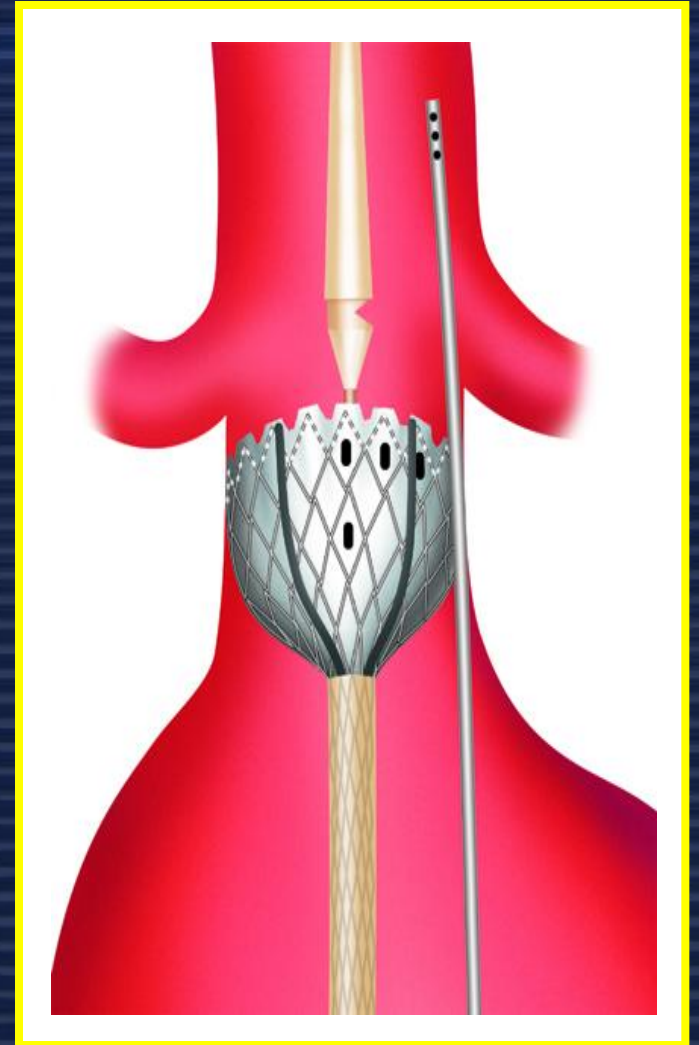
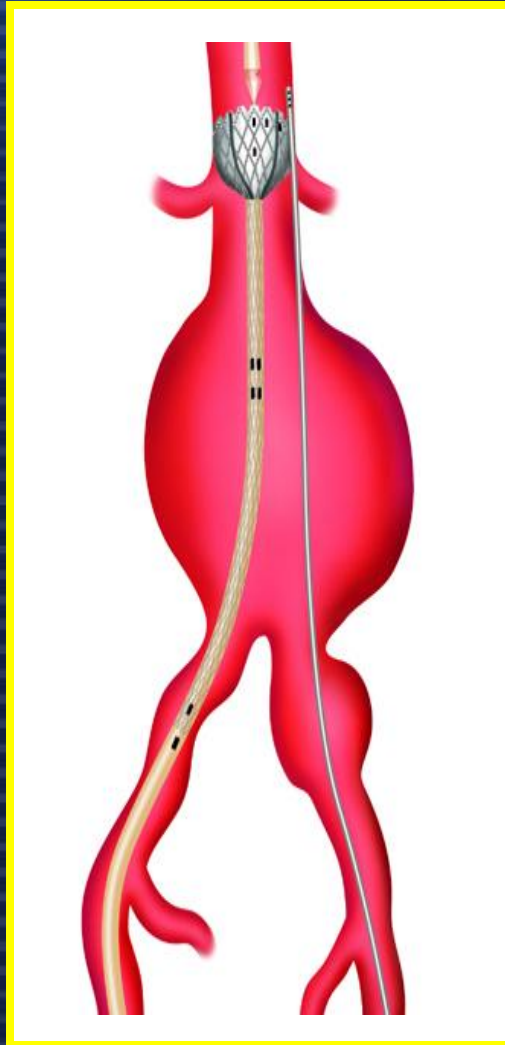
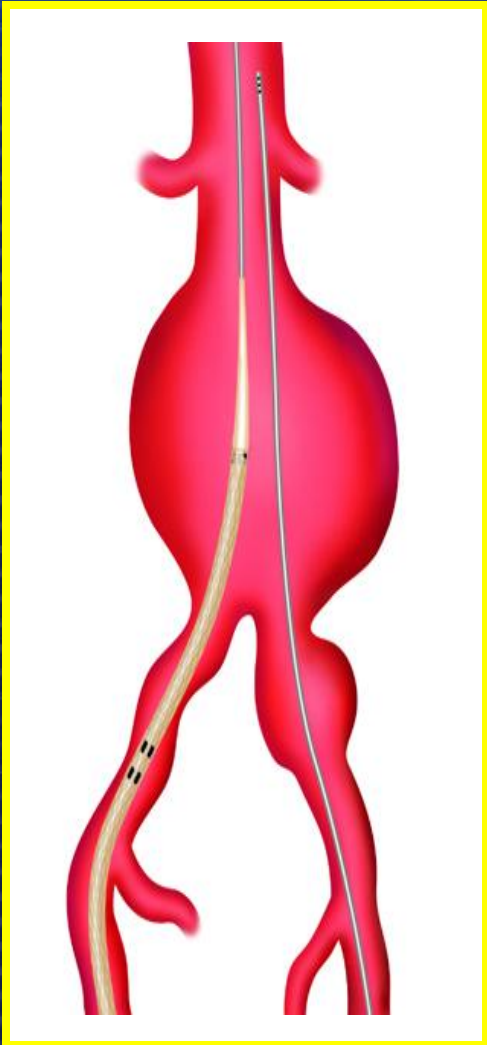
IMPACT OF ENDOLUMINAL AORTIC REPAIR

WASHINGTON UNIVERSITY/BARNES-JEWISH HOSPITAL

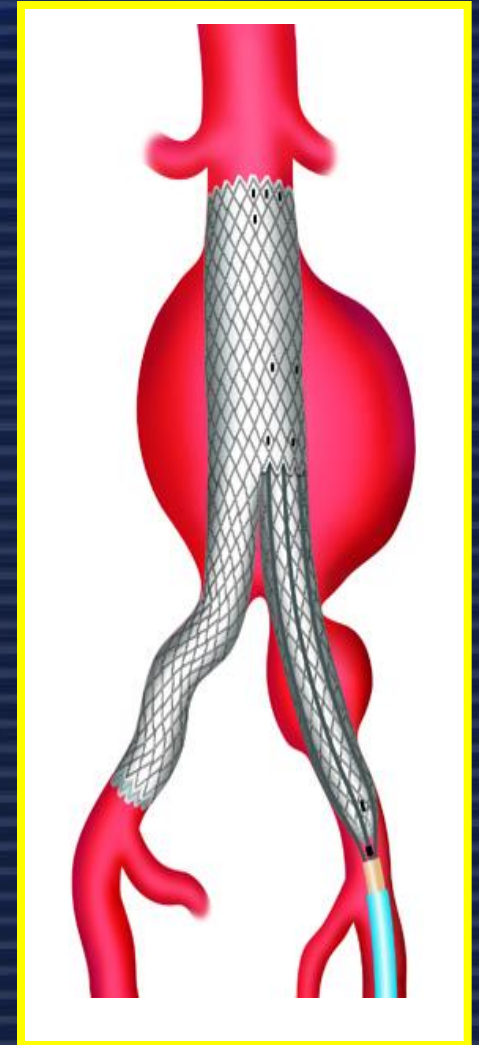
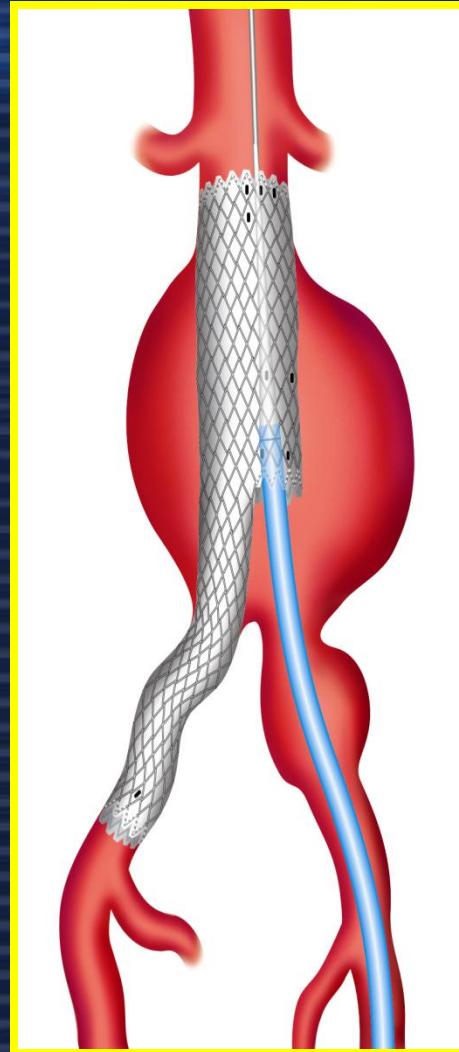
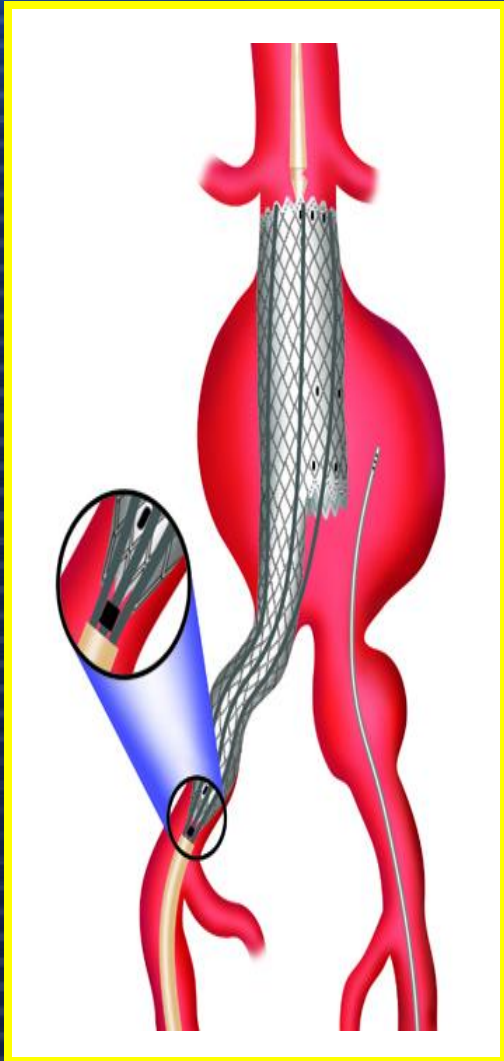
1996-2003



Modular Bifurcated Graft Implantation



Modular Bifurcated Graft Implantation



Attachment: Fixation and Sealing

Fixation: Ability of an endograft to resist displacement (measured as graft migration)

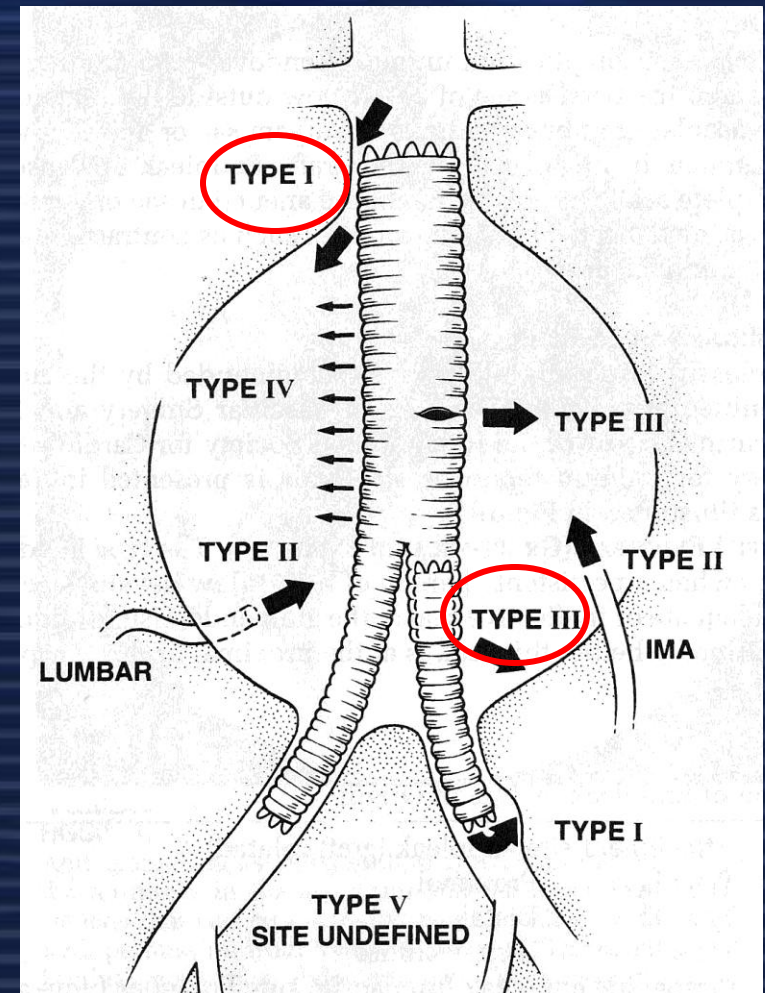
Sealing: Mechanical barrier to prevent attachment site endoleak



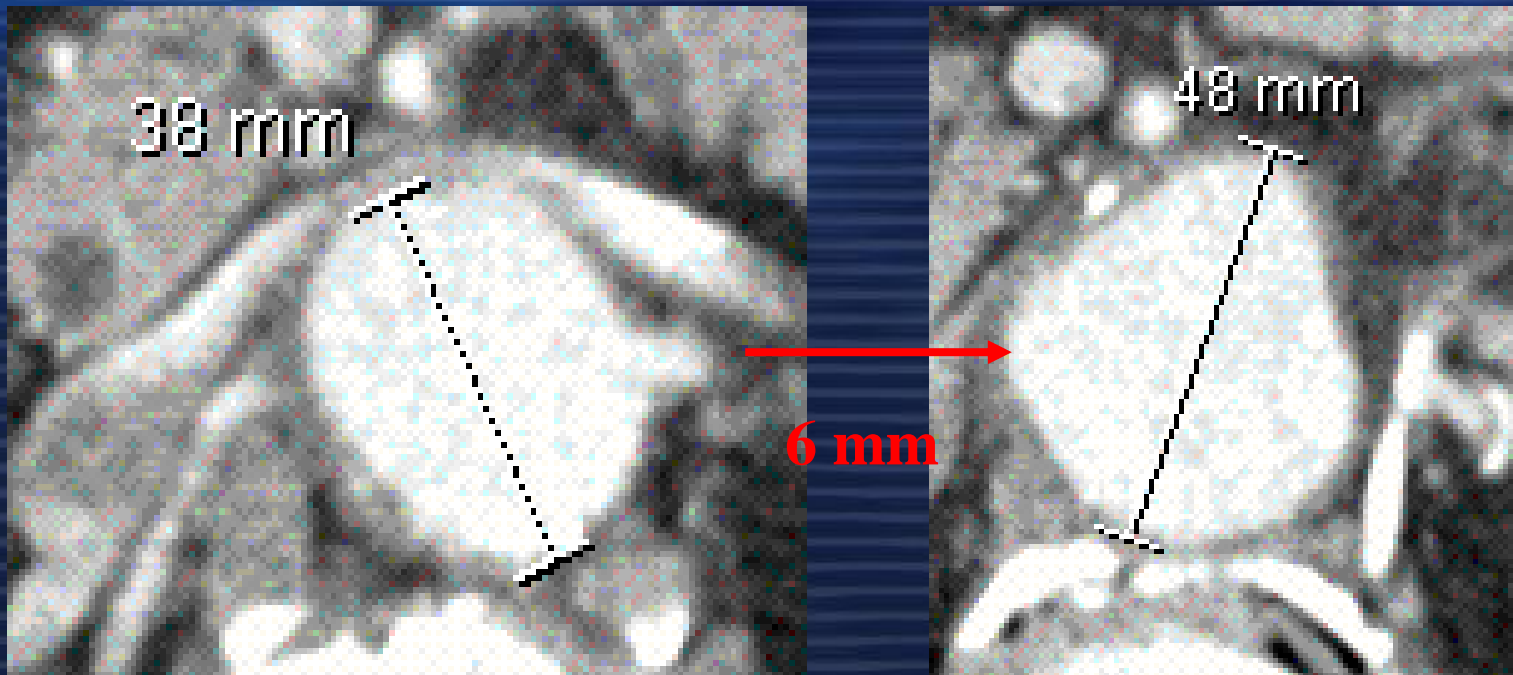
Endoleaks

A unique complication of endovascular therapy

- Detected by CT scan
- 5 “types”
- Types I & III result in transmission of systemic pressure to the AAA sac
- CT scan at 1, 6, 12 months, then annually FOR LIFE!

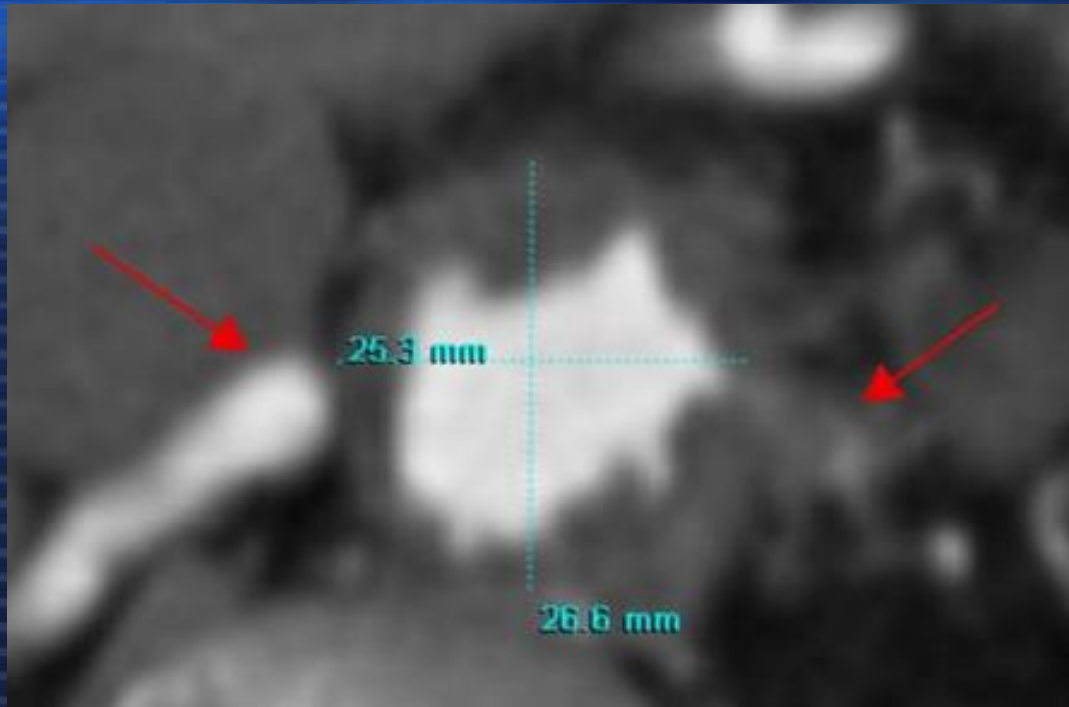


Patient Selection



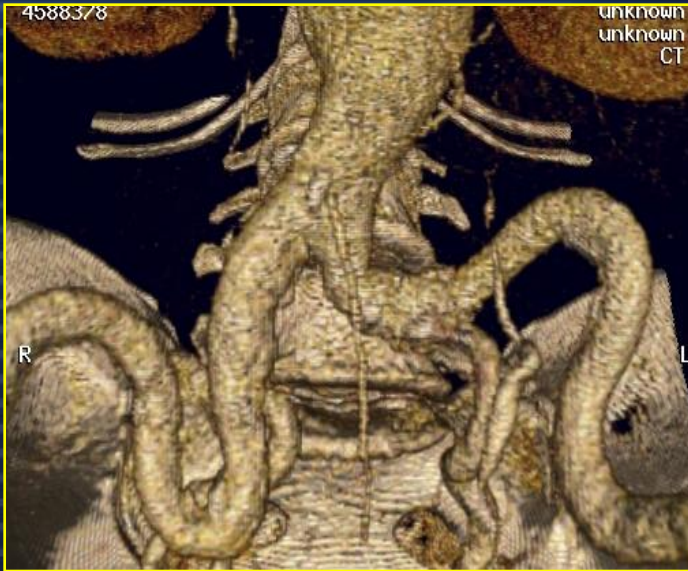
- Can we obtain adequate fixation and sealing?
 - Short neck
 - Wide neck

Patient Selection



- Can we obtain adequate fixation and sealing?
 - Thrombus in neck
 - Severe neck angulation

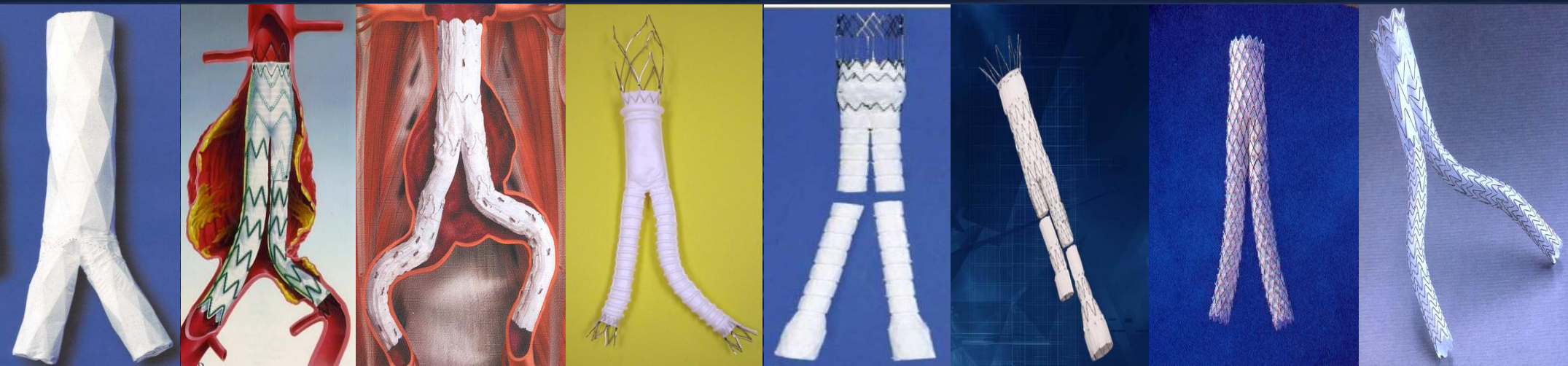
Patient Selection



- Can we deliver and deploy the device?
 - Aortic or iliac stenosis or occlusion
 - Tortuosity or angulation

Newer Generation Devices

- More flexible, trackable
- Lower profile (smaller diameter during delivery)
- Larger diameter (able to treat bigger necks)
- Improvements in bioprosthetic properties based on failure analysis



Today's Commercially Available Endograft Options

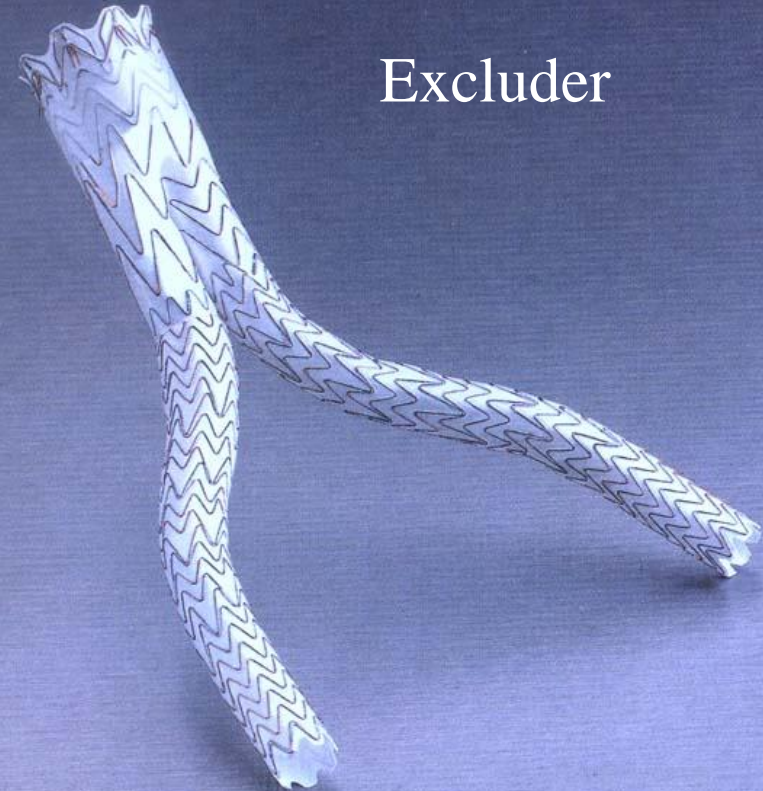
Zenith



AneuRx



Excluder



Endovascular AAA at CRMC

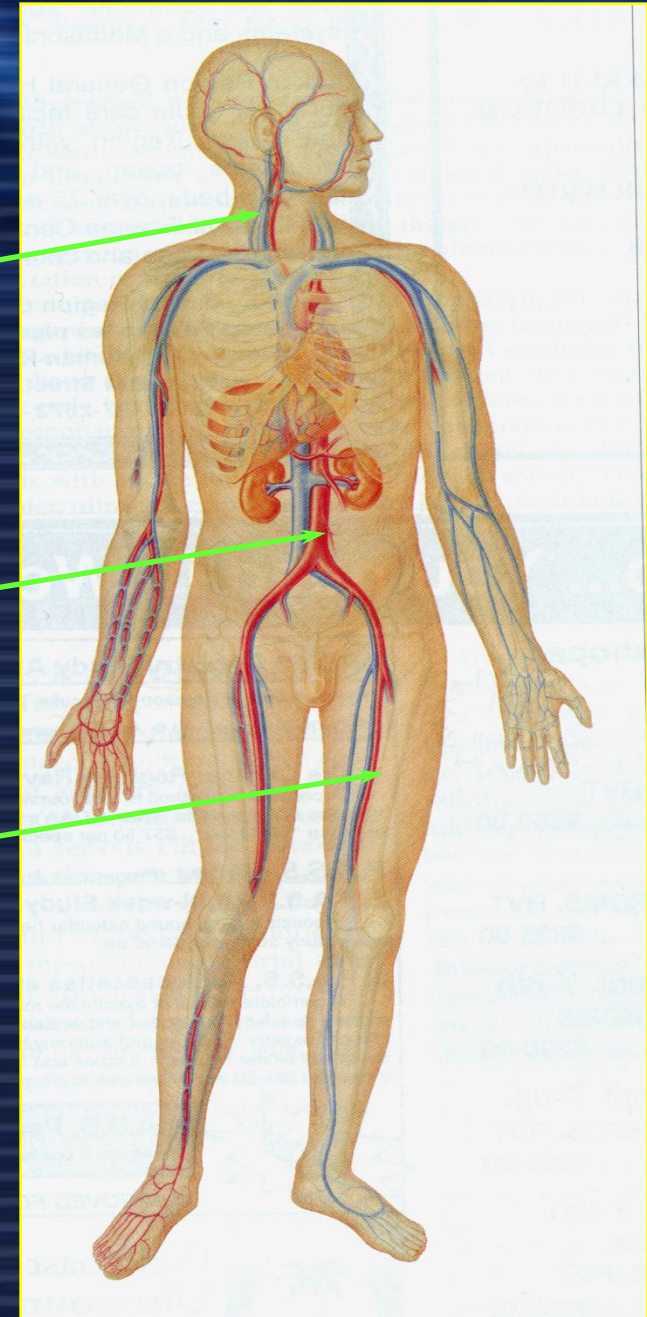


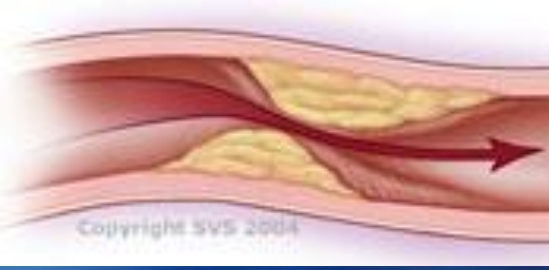
Conclusions

- Growing recognition that endovascular AAA repair is the safest option for ALL patients
- Multivariable risk analysis to identify when to operate
- Newer generations devices demonstrate product evolution
- Branched & fenestrated devices may have a future role

Vascular Surgery

- Carotid Disease
- Abdominal Aortic Aneurysms
- Peripheral Arterial Disease
- Venous Disease





Risk Factors

- Age > 60
- Smoker > 10 years
- Diabetic
- Hypertension
- Obesity
- High cholesterol
- Inactive or bedridden
- FH of heart attack or stroke

PRESENTATION

- Intermittent Claudication
 - Ischemic muscle pain during exercise secondary to inadequate O₂ delivery that resolves with rest
 - Cramping in buttock, thigh, or calf
- Rest Pain
 - Inadequate blood flow to meet metabolic requirements
 - Localized to forefoot, awakens patient at night
- Tissue Loss/Gangrene

Ankle Brachial Index (ABI)

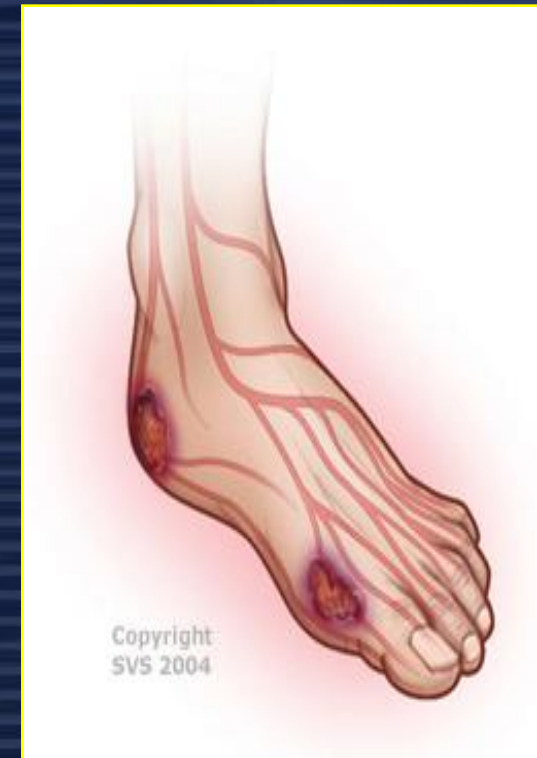
ABI=Highest Ankle BP/Highest Brachial BP

- Fast, effective screening tool for PAD
- Simple, inexpensive, and non-invasive
- Predictor of morbidity and mortality

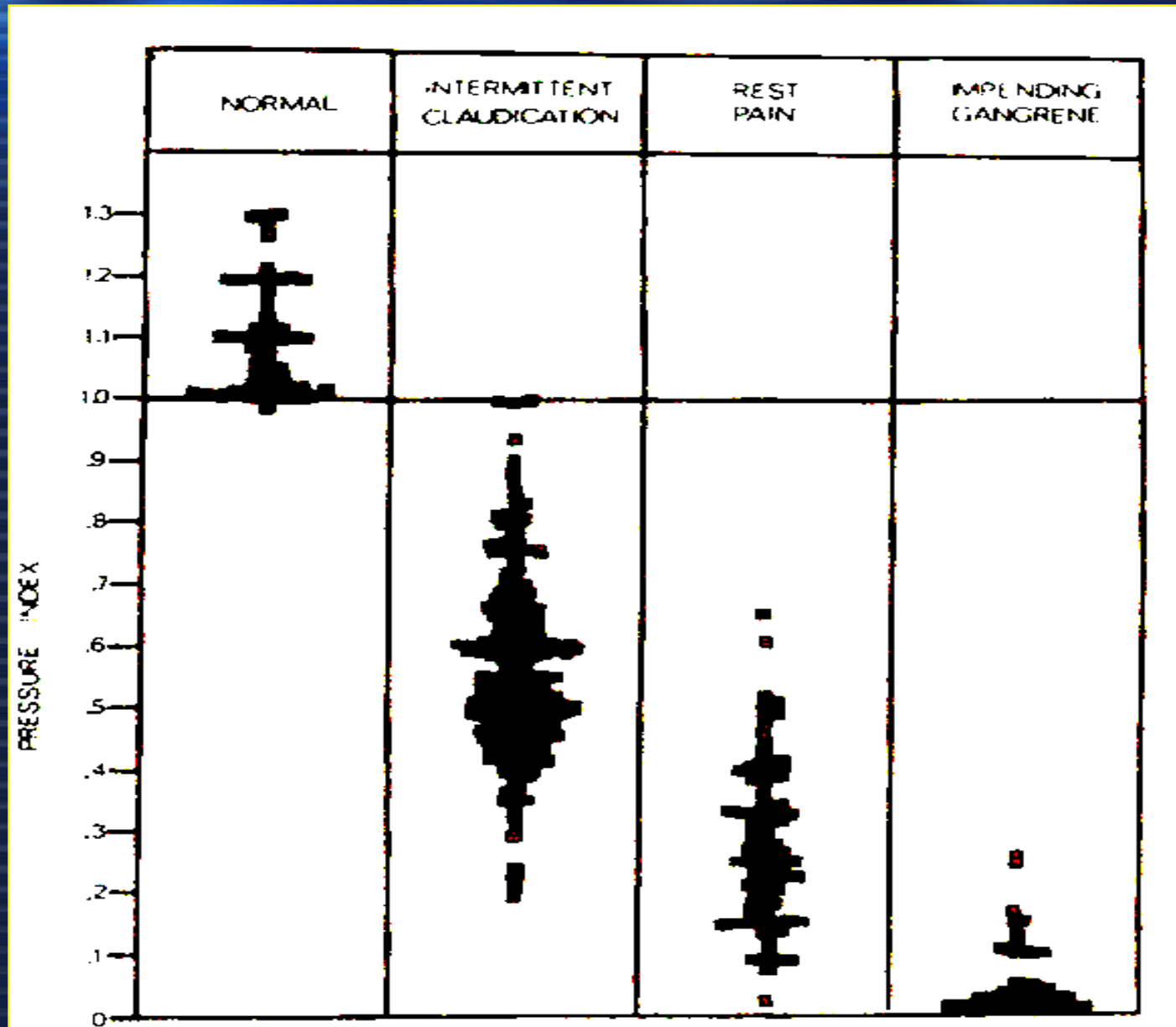


Diagnostic Criteria: ABI

- Normal >0.95
- Single level disease >0.50
- Multilevel disease <0.50
- Critical ischemia <0.30



Ankle Brachial Index Categories

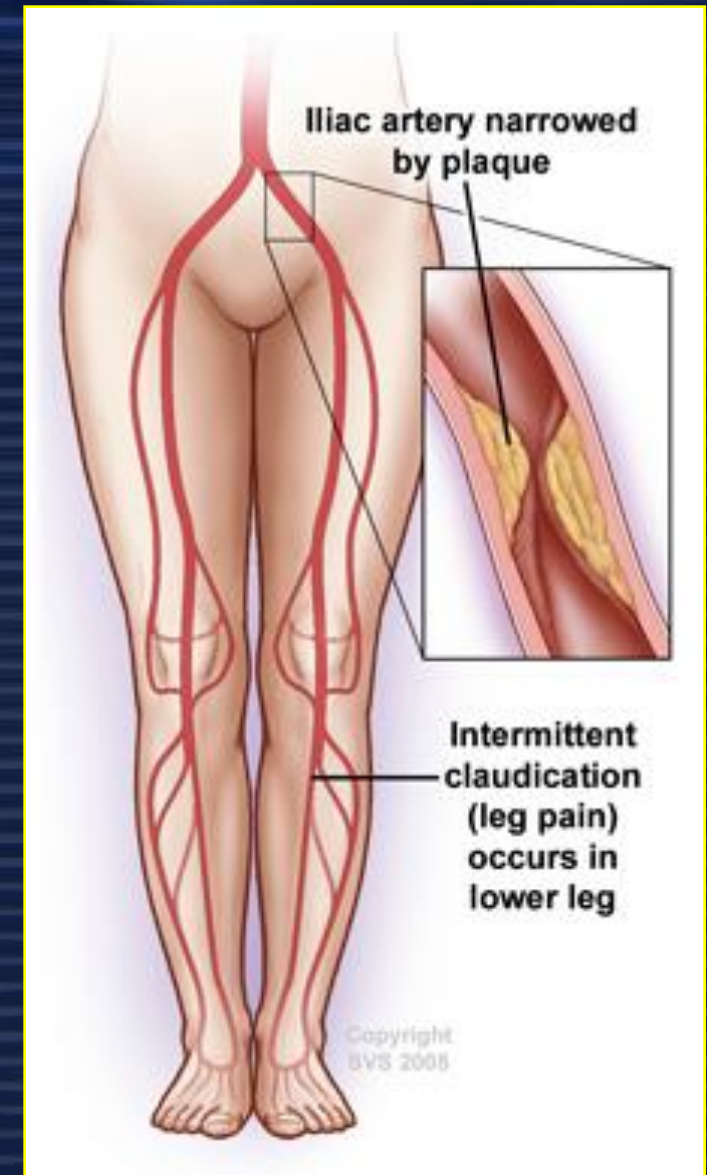


Fontaine Classification: Clinical

- I Asymptomatic
- II Intermittent claudication
 - » A >200 meters
 - » B \leq 200 meters
- III Rest pain
- IV Necrosis, gangrene, non-healing wound

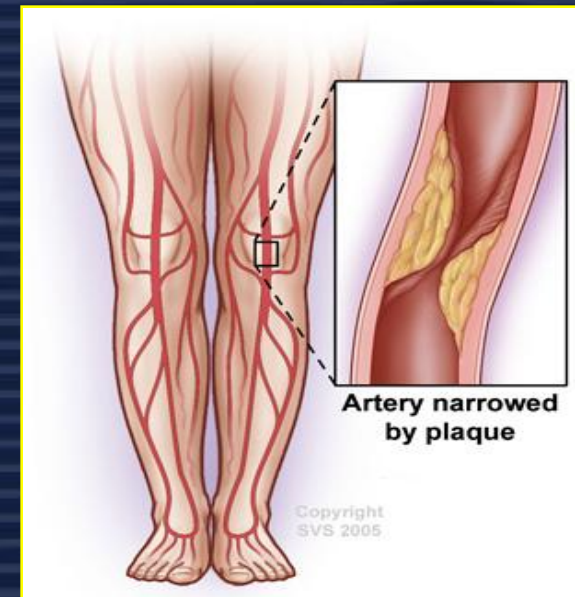
Risk Factor Modification

- Lipid Management
- Weight Reduction
- Smoking Cessation
- Blood Pressure Control
- Exercise Program



Indications for Invasive Therapy in IC

- Predicted or observed lack of response to exercise therapy and risk factor modification
- Disability compromising ability to work or seriously impairing activities important to the patient

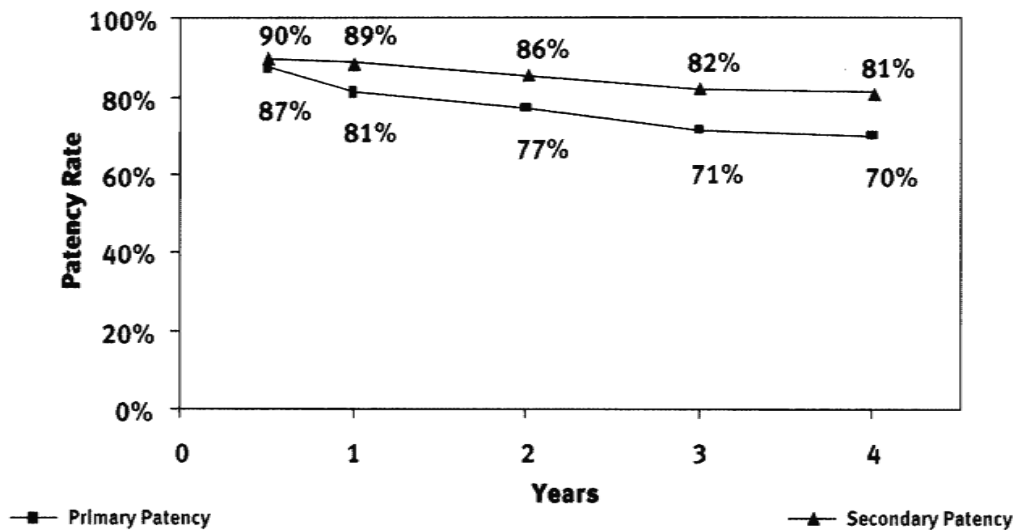


Indications for Invasive Therapy in IC

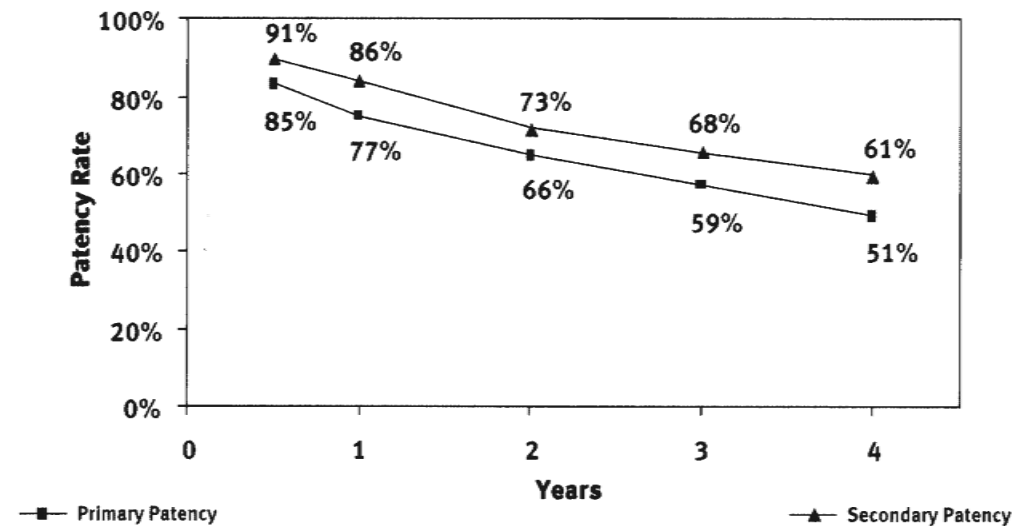
- Absence of other disease that would limit exercise even if claudication was improved
- Patient's anticipated natural history and prognosis
- Lesion morphology associated with low risk and high probability of initial and long-term success

What is the “Gold Standard” Femoral Popliteal Bypass?

Weighted Mean Patency of Vein Bypass



Weighted Mean Patency of Prosthetic Bypass



Preoperative Imaging

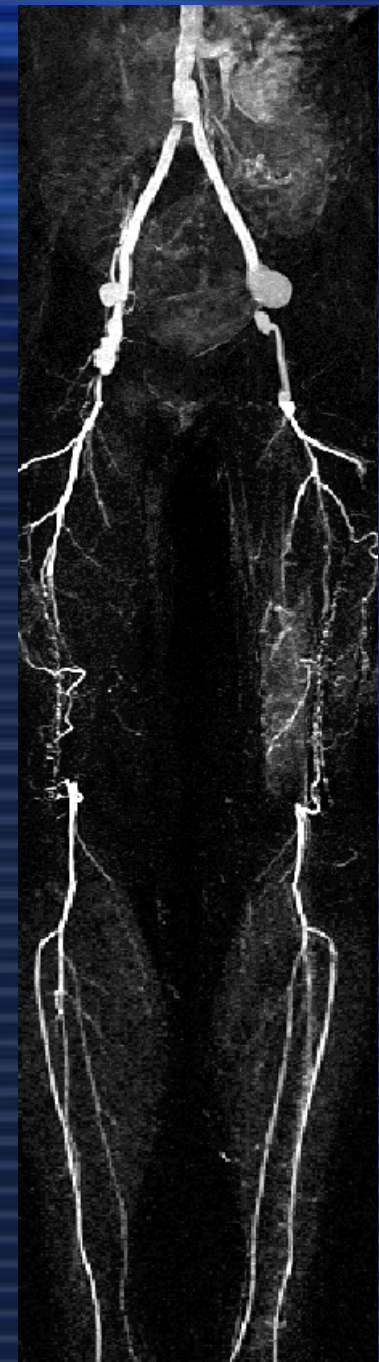


Arterial Duplex

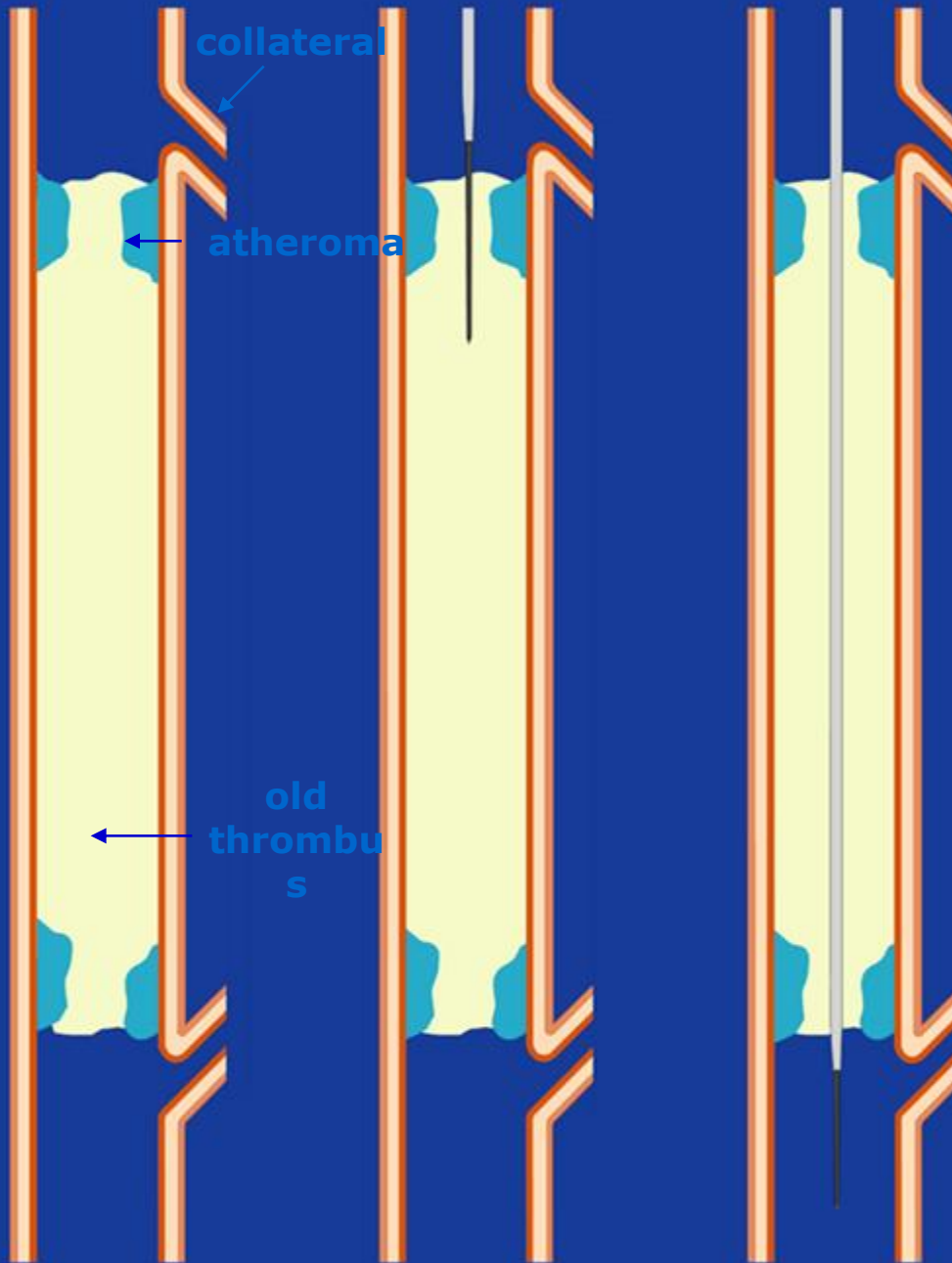
CT Angiography

MR Angiography

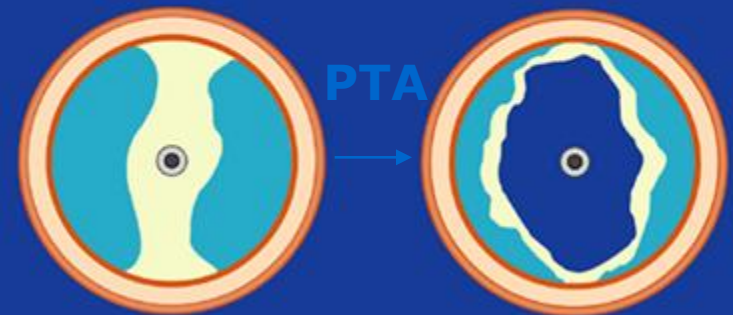
Arteriography



Intraluminal Angioplasty

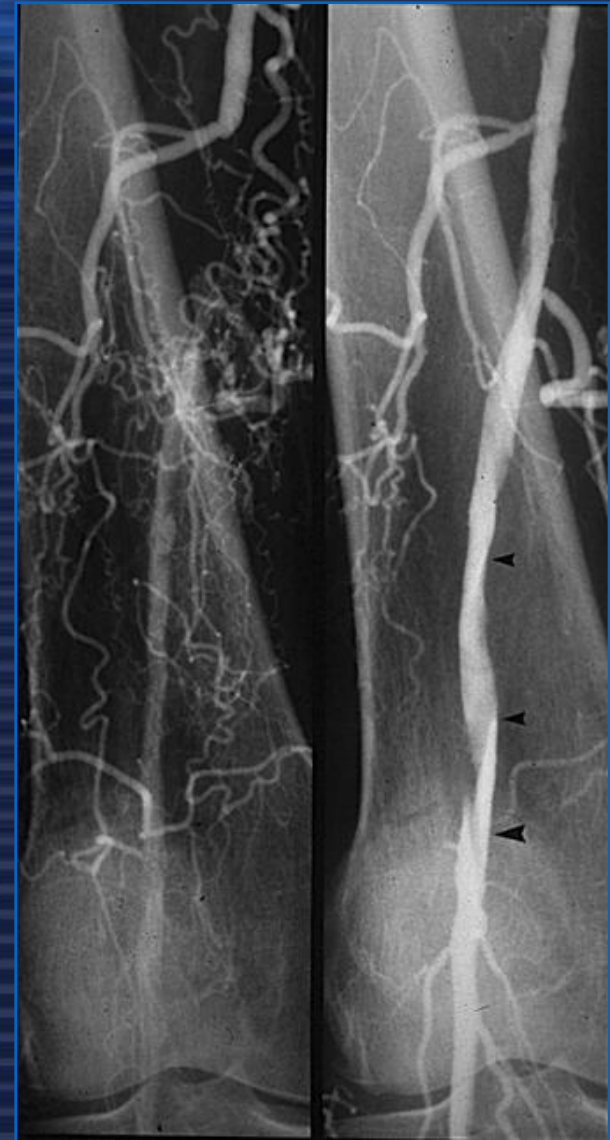


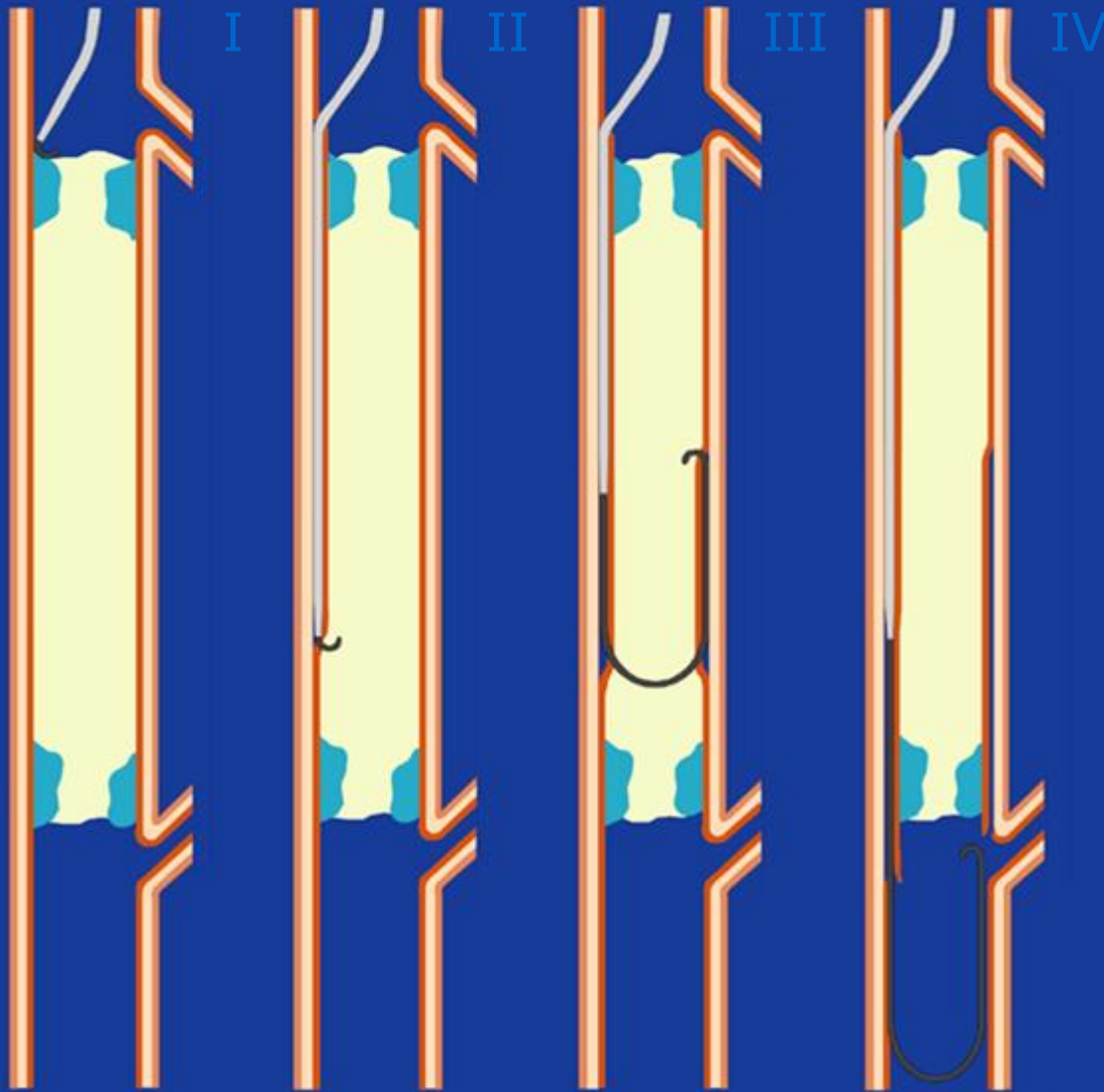
Cross-section



Subintimal Angioplasty

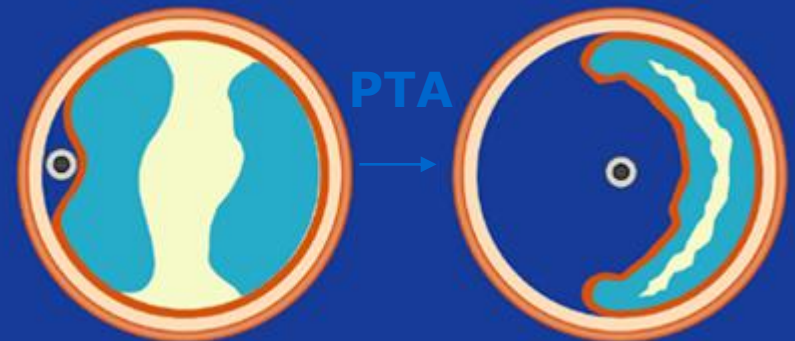
- Introduced by Amman Bolia
- Proven as an acceptable approach
- Particularly helpful with large collateral at level of occlusion
- Failures occur at re-entry (10-20%)
- “Privileged” location?
- Re-introduces collaterals?





Subintimal Angioplasty

Cross-section

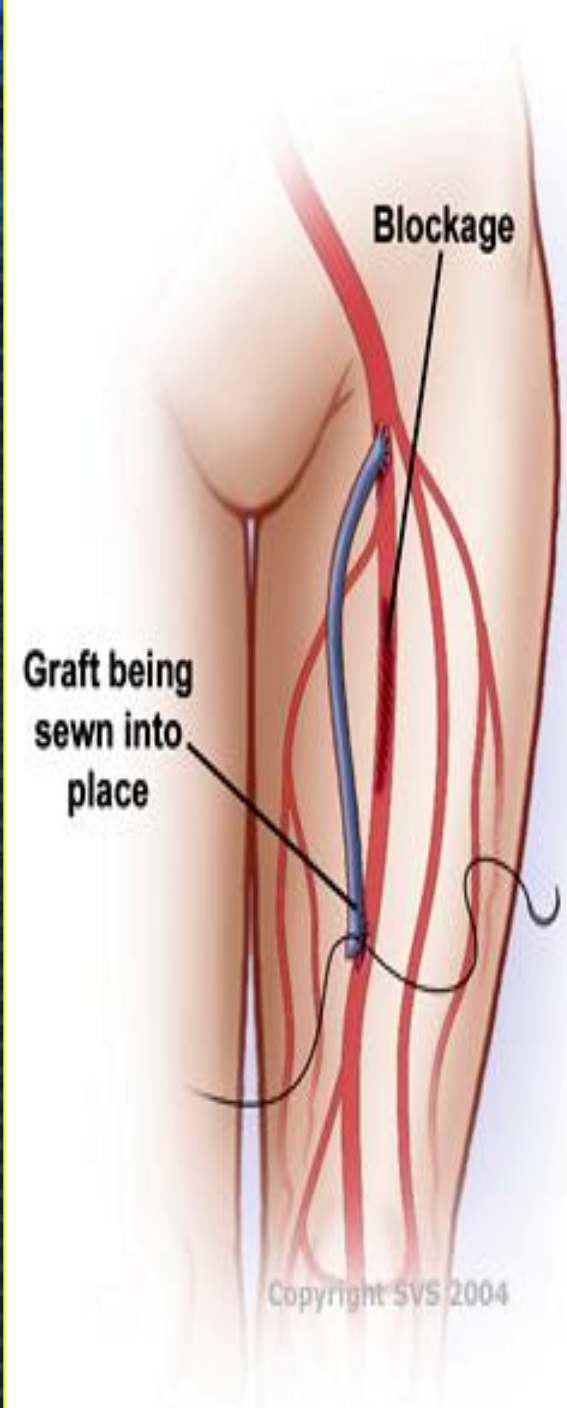


Results (Bell)

- >1000 cases
- Occlusions up to 40 cm in length
- Technical success 86%
- 6 yr primary patency 55%
- 3 cases needed fem-pop bypass
- Failure usually results in return to pretreatment status

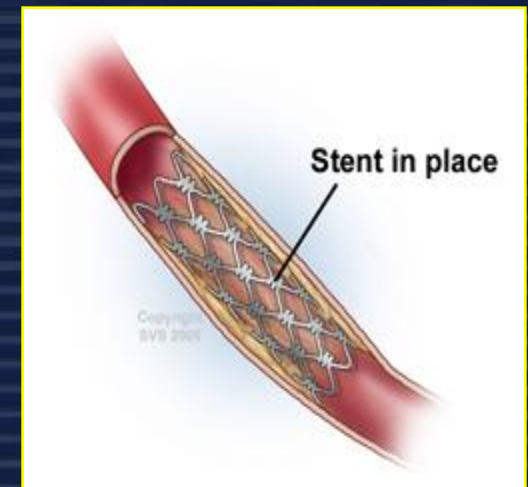
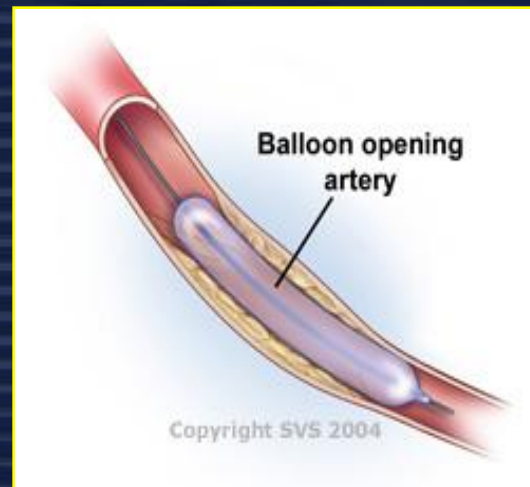
Traditional Approach

- Due to low but appreciable operative mortality, and benign outcomes with respect to limb loss, claudicators were **managed conservatively** until hemodynamic and clinical criteria suggested progression to **limb-threatening disease**



Paradigm Change

- Claudication unresponsive to conservative treatment is now being aggressively treated via **endoluminal approach**
- Substantial practice changes within the vascular surgery community



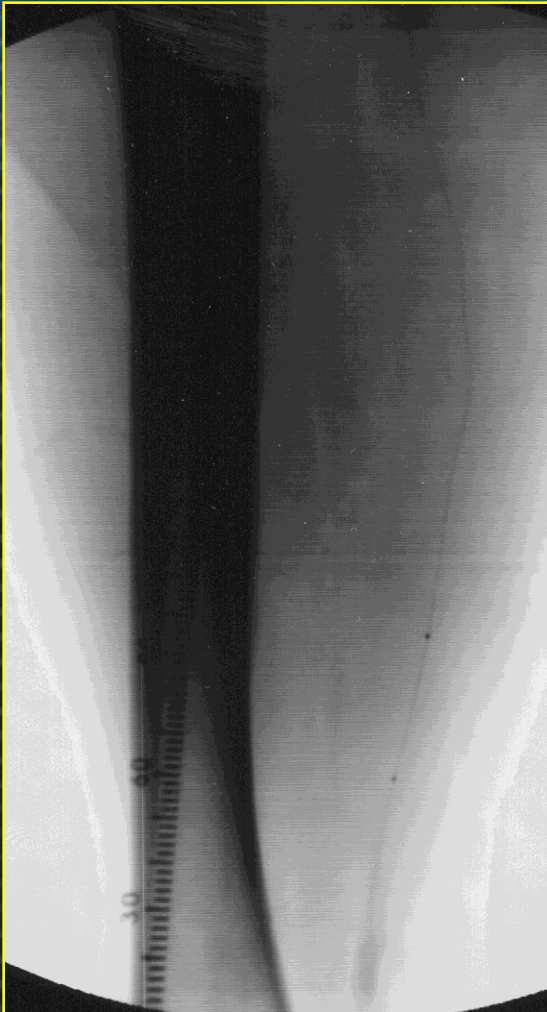
SFA- Focal Lesion- PTA



SFA- Long Segment Occlusion



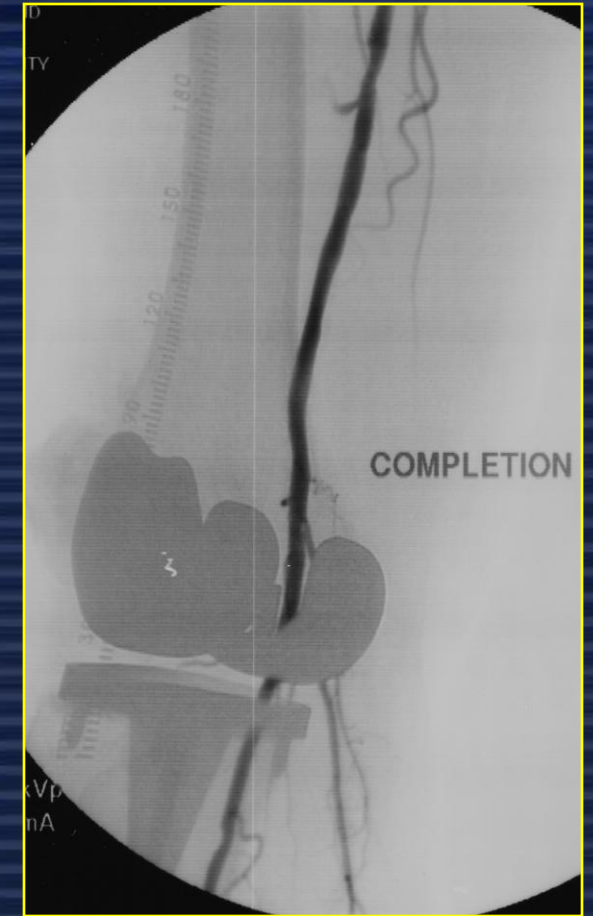
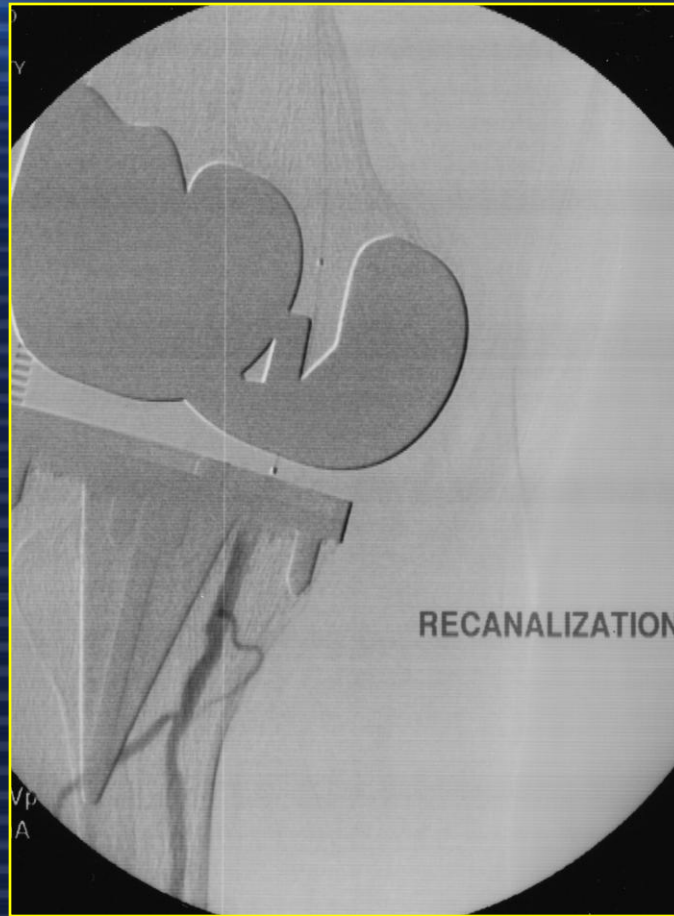
SFA- Long Segment Occlusion



SFA- Short Segment Occlusion



SFA- Medium Length Occlusion



Thank You

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